Metals Review

THE NEWS DIGEST MAGAZINE

Published by the American Society for Metals

Volume XXII, No. 12 FEATURING: CRYSTAL STRUCTURE December, 1949

W.C.C. RESEARCH

JAN 4 1950

LIBRARY

A Merry Christmas and a Happy New Year

A. F. Holden

President

THE A. F. HOLDEN COMPANY • Metallurgical Engineers

MANUFACTURERS OF HEAT TREATING BATHS & FURNACES

NEW HAVEN 8, Conn. 1627 W. Fort Street, Detroit 16, Mich.

FOREIGN MANUFACTURERS: Canada Peacock Brothers, Ltd., Montreal France-Fours Electriques Ripoche, Paris Belgium Le Four Industriel Belge, Antwerp

REPRESENTATIVES IN TWENTY-ONE FOREIGN COUNTRIES

In FORGING

YOU NEED THE AUTHORITY OF ALL THESE PRACTICAL ASM BOOKS

Forging Handbook

By Waldemar Naujoks, *B.S., M.E., Mgr., Forged Valve Div., Ohio Injector Co.*

and Donald C. Fabel, *B.S., M.S., Head of Mechanical Engineering Dept., Fenn College*

This vast fund of essential knowledge is organized for instant application to your forging problems—with every feature needed to help you use it most effectively.

TABLE OF CONTENTS

The forging industry . . . forge plant equipment . . . die block and process operation . . . forge dies and tools . . . forging practice . . . finishing operations . . . heat treatment of forgings . . . cleaning of forgings . . . testing and inspection of forgings . . . materials handling . . . forge plant design . . . forge plant maintenance . . . furnaces and furnace design . . . designing the forged part . . . forging materials . . . job estimating . . . costs and cost engineering . . . forge shop safety . . . forging definitions . . . mathematical tables and data.

630 pages . . 6 x 9 . . 426 illus. . . red cloth . . $7.50

The Book FOR Steel Experts, BY Steel Experts

Modern Steels

Edited by Ernest E. Thum, *Editor, Metal Progress*

Chapters by Max W. Lightner, *Carnegie-Illinois Steel Corp.;* G. R. Fitterer, *University of Pittsburgh;* Franklin H. Allison, Jr., *United Engineering & Foundry Co.;* A. W. Demmler, *Vanadium Corp. of America; and* James P. Gill, *Vanadium-Alloys Steel Co.*

TABLE OF CONTENTS

Raw materials and production of pig iron . . . steel making process . . . steel pouring . . . hot working, rolling and forging . . . inspection and testing of steels . . . metallography: equilibrium structures and steels . . . metallography: slowly cooled irons and steels . . . metallography: quenched and tempered steels . . . heat treatment: softening and hardening . . . heat treatment: equipment . . . alloy steels . . . stainless steels . . . tool steels . . . comprehensive 14-page index.

374 pages . . 150 illus. . . 6 x 9 . . red cloth . . $4.00

The Working of Metals

A Symposium by 21 Authors

An outstanding symposium on the plastic deformation and working of metals, presented at the National Metal Congress.

TABLE OF CONTENTS

Laws and Fundamentals of Plastic Deformation . . . Metallic Single Crystals and Plastic Deformation . . . Creep Characteristics of Metals . . . Interpretation and Use of Creep Results . . . Damping Capacity—Its Variation and Relation to Other Physical Properties . . . Elastic Properties and Their Relationship to Strength and to Strain Hardening . . . The Effect of the Shape of the Test Piece upon the Energy Needed to Deform Materials in the Single-Blow Drop Test . . .Hot Working, Cold Working and Recrystallization Structure . . . Factors Relating to the Production of Drop and Hammer Forgings . . . Hot Press and Upset Forging . . . Extrusion of Metals . . . Cold Heading—Bolts, Rivets and Nails . . . Cold Forming Processes—Drawing Rods and Bars . . . Cold Drawing Seamless Steel Tubes . . . Cold Rolling of Mild Steel Sheets and Strip . . . Some Factors Affecting the Plastic Deformation of Sheet and Strip Steel and Their Relation to the Deep Drawing Properties . . . Cold Working of Hollow Cylinders by Auto-Frettage.

469 pages .. Illus .. Cloth .. $5.00

Talks About Steelmaking

By Harry Brearley

Written from a wealth of experience in steelmaking.

TABLE OF CONTENTS

Beginnings . . . chemical analysis . . . microscopes . . . molten steel . . . melting processes . . . Huntsman . . . Bessemer . . . Siemens . . . Thomas . . . Electric . . . Forging . . . testing steel . . . notch fractures . . . making specifications . . . chemical composition . . . mechanical properties . . . clean steel . . . the job's the boss . . . complaints . . . remunerations . . . helpful comparisons . . . "scrapalurgy".

236 pages .. Illus. .. Cloth .. $4.00

TESTED SOLUTIONS FOR HUNDREDS OF PROBLEMS IN THE FIELD OF METAL PRODUCTION, PROCESSING AND USE

Practical Metallurgy

By George Sachs, *Dipl. Ing., D. Eng., Case Institute of Technology, and* Kent R. Van Horn, *B.S., M.S., Ph.D., Aluminum Co. of America*

The wide appeal of this compact 567-page book is its simple, concise solutions to hundreds of problems in the field of metal production, processing and use.

TABLE OF CONTENTS

The constitution of alloys . . . grain structure of alloys and segregation . . . the crystal structure of metals and alloys . . . phase changes in the solid state . . . deformation and recrystallization . . . residual stresses . . . furnaces and general melting problems . . . castings I: production . . . castings II: mechanical properties . . . castings III: special casting alloys and methods . . . ingots . . . mechanical working I: fundamentals . . . mechanical working II: rolling, forging and extrusion . . . mechanical working III: drawing, straightening and fabricating . . . heating, annealing and heat treatments . . . heat treatment of steels . . . heat treatment of nonferrous metals . . . appendix—binary constitutional diagrams.

567 pages..red cloth..6 x 9..335 illus...$6.00

American Society for Metals
7301 Euclid Ave., Cleveland 3, Ohio

Please send me the following ASM Books

- ☐ Forging Handbook
- ☐ Modern Steels
- ☐ Practical Metallurgy
- ☐ Talks on Steelmaking
- ☐ Working of Metals

NAME .....

COMPANY .....

TITLE .....

ADDRESS .....

CITY ..... ZONE ..... STATE .....

INVOICE COMPANY ☐ INVOICE ME ☐ CHECK ENCLOSED ☐

Metals Review

THE NEWS DIGEST MAGAZINE

RAY T. BAYLESS, Publishing Director MARJORIE R. HYSLOP, Editor GEORGE H. LOUGHNER, Production Manager

VOLUME XXII, No. 12 DECEMBER, 1949

A.S.M. REVIEW OF METAL LITERATURE

ORE BENEFICIATION 26
Preparation and Concentration

SMELTING, REDUCTION AND REFINING 27
(Including Electrolytic Refining)

PROPERTIES 29
Physical, Mechanical and Chemical

CONSTITUTION AND STRUCTURE 34
Metallography, Constitution Diagrams, Crystal Structure

POWDER METALLURGY 38
Processes and Products

CORROSION 38
Theory, Measurement, Prevention (Except Coatings)

CLEANING AND FINISHING 41
Chemical and Mechanical; All Types of Coatings Except Electrodeposited

ELECTRODEPOSITION AND ELECTROFINISHING 42
(Plating, Electropolishing, Electroforming)

PHYSICAL AND MECHANICAL TESTING 43
(Including Stress Analysis)

ANALYSIS 45
Qualitative and Quantitative; Identification Methods

APPARATUS, INSTRUMENTS AND METHODS 47
Industrial Measurement and Control (Except Temperature); Laboratory Equipment and Procedures

INSPECTION AND STANDARDIZATION 48
(Including Quality Control, Radiography, Specifications)

TEMPERATURE MEASUREMENT AND CONTROL 49

FOUNDRY PRACTICE 49
Methods and Equipment (Except Furnaces)

SCRAP AND BYPRODUCT UTILIZATION 51

FURNACES AND HEATING DEVICES 51
(Including Induction and Resistance Heating Equipment)

REFRACTORIES AND FURNACE MATERIALS 52

HEAT TREATMENT 52
(Including Flame Hardening, Induction Heating, Cold Treatment)

WORKING 54
Rolling, Drawing, Forging, Stamping and Presswork, Shot-Peening

MACHINING 55
(Including Tools, Machinability and Cutting Fluids; Excluding Flame Cutting)

MISCELLANEOUS FABRICATION 57
General Manufacturing and Assembly Procedure; Plant Operations; Material-Handling

JOINING AND FLAME CUTTING 58
Welding, Brazing and Soldering

APPLICATIONS 61
General and Specific Uses of Metals

DESIGN 61
Metallurgical Factors in Design of Parts, Equipment and Structures

MISCELLANEOUS 62
(Including Research, Lubrication and Friction; Other General and Unclassified Subjects)

SPECIAL FEATURES

Crystal Structure and Phase Transformations (A Review of Fundamental Research), by J. Robert Doig . . . 4

A.S.M. Annual Meeting and Officers' Reports 8

Appointments to A.S.M. Standing Committees 10

IMPORTANT LECTURES

British Steel Industry Research — Sir Charles Goodeve 7

Ductile Iron — William H. Sparr . . 11

Low Cost Steel for Low Temperatures — T. N. Armstrong 12

High Speed Gas Heat for Forging and Heat Treating — Charles A. Turner, Jr. 13

Boron Steels for Small Parts on Large Scale — Fred J. Robbins 14

Brittle Failures — Maxwell Gensamer . 15

Machinability Tests — George P. Witteman 16

Spring Manufacture — E. T. Bittner . 17

Large Forgings — F. B. Foley . . . 18

Toolsteel Failures — J. Y. Riedel . . 19

Material and Fabrication Choice — J. A. Burgard 19

Scientific Foundry Methods — C. K. Donoho 20

Practical Pointers Aid Heat Treater — J. C. Youlten 21

New Applications for Magnesium Alloys — Ralph L. Huft 23

Steel-Clad Brick — M. A. Fay . . . 25

DEPARTMENTS

Thirty Years Ago 11

New Films and Speakers 13

Compliments 18

Meeting Calendar 22

Employment Service Bureau 60

Advertisers' Index 63

Published monthly by the American Society for Metals, 7301 Euclid Ave., Cleveland, Ohio; Arthur E. Focke, President; Walter E. Jominy, Vice President; William H. Eisenman, Secretary; Ralph L. Wilson Treasurer. Thomas G. Digges, Elmer Gammeter, Fred. J. Robbins, Harry P. Croft, Trustees; Harold K. Work, Past President. Subscriptions $5.00 per year ($6.00 foreign). Single copies $1.00. Entered as Second Class Matter, July 26, 1930, at the Post Office at Cleveland, Ohio, under the Act of March 3, 1879

Crystal Structure and Phase Transformations

A Review of Fundamental Research

By J. Robert Doig
Battelle Memorial Institute

METALS AND ALLOYS, like other crystalline solids, are constructed of atoms packed together in regular arrangements. The atoms behave as if they were almost spherical, especially in pure metals. Hence, for demonstration purposes, crystal models are usually constructed of balls packed in boxes or mounted on wires. However, these models are stationary; they do not show how the atoms move when the metal is deformed.

Sir Lawrence Bragg and his associates (4A-37, May 1949*) recently performed some experiments with working models of metal structures. For these experiments they chose soap bubbles, which, as has been frequently noticed, arrange themselves in regular atom-like packing. Bragg's purpose was to study the motions that the bubbles make when their regular arrangements are distorted out of their usual positions by applied stress. This would give an analogy between behavior of the bubble models and the events that take place on an atomic scale when a metal is stressed beyond its yield point.

The models consisted of rafts of uniform-sized bubbles floating on soap solution. In single layers they packed together as hexagons, and in multiple layers as hexagonal or cubic close-packed structures. It was found that the models had many of the properties of metals.

Upon stirring, for example, a "fine grain" was produced which gradually recrystallized into larger grains. The distorting effect of the few larger "foreign atom" bubbles was seen to extend for considerable distances around them. The grain boundaries then shifted gradually until they included these bubbles.

These regular structures are held together by the capillary forces and held apart by the pressure exerted at the interfaces where they touch. Experimental measurements of Young's modulus and Poisson's ratio agreed well with values calculated from the attractive and repulsive forces involved.

When single crystal rafts were strained sufficiently, the bubbles began to lose contact at the interfaces where tension existed. With a further increase in strain, some bubbles suffering compression and shear would slip past one another for a distance of one bubble diameter. At each side of the place where slip started, misfits were produced where one plane had one more atom than the next. These misfits were the dislocations about which much is being written at present. Dislocations which formed in pairs within the grain then moved in opposite directions, as predicted by theory. The measured stress periodically reached a maximum and dropped off suddenly after the dislocations had formed (3A-45, April 1949).

The critical shear strain at which this slip occurred decreased with decrease in bubble size because the smaller bubbles behaved more rigidly than the large ones. An intermediate bubble size with a critical shear strain of 3.25 minutes of arc showed the closest comparison with pure copper.

In recent years, the study of crystal structure and phase transformations in alloys has covered a broad field of metallurgical interest. Study of the mechanism of the martensitic type of transformation and the effect of applied stress on it has been particularly fruitful during the past year. Following recent progress in the mechanism of phase transformations in general, new studies—largely theoretical—are being made on the nucleation of phase transformations.

Martensitic Transformations

In general, phase transformations which occur during heat treatment are divided into two types. In the more common type, the atoms move by diffusion into the crystal lattice positions which they are to occupy in the final crystal structure, as in the transformation of austenite into ferrite and cementite. In the martensitic type, of which the transformation from austenite to martensite is the well-known prototype, the parent solid solution merely undergoes a change in its crystal structure by shear movements not involving diffusion. This type of transformation, once thought to be a freak peculiar to steel, is quite common in other alloy systems and even in pure metals.

It has six characteristics which distinguish it from other transformations, according to Kurdyumov (4A-2, Feb. 1949). First, no precipitation occurs but only a change in the lattice of the solid solution. Second, definite orientation relationships exist between the parent lattice and the end lattice. Third, the transformation takes place at considerable degrees of undercooling and over a wide temperature range, the quantity transformed being dependent principally on the temperature to which the alloy is cooled, rather than the time of holding at that temperature. Fourth, the transformation is not suppressed by rapid cooling. Fifth, it takes place almost instantly. Sixth, plastic deformation can induce the transformation in a certain temperature range above the Ms point, and can increase the amount of transformation when applied below the Ms point. The ability of the parent phase to stabilize itself against transformation might also be included as another property of the martensitic type of reaction.

In the realm of pure metals, Troiano and Tokich showed that in cobalt the transformation from the face-centered cubic to the hexagonal close-packed form is of the martensitic type (4c-28, 1948). A thermal arrest in the cooling curve of this metal occurs at about 388° C. regardless of cooling rate. Body-centered cubic lithium transforms partially to a hexagonal close-packed structure on cooling below an Ms temperature of −202° C. (4d-9, 1948). If the metal is cold worked above this temperature but below another temperature, M_{s_1}, it transforms partially to face-centered cubic.

Transformations somewhat analogous to that in lithium are found for the beta phases of the Cu-Al, Cu-Sn, and Cu-Zn systems (4A-2, Feb. 1949). Here again the transformation is from body-centered cubic to hexagonal close-packed or nearly so. The Cu-Al system is especially interesting, for two martensitic transformations are found—one to a hexagonal close-packed structure at higher aluminum contents, and the other to a distorted hexagonal at lower aluminum contents. A limited two-phase region exists between the two single-phase fields.

Several studies of the mechanism of martensite formation and the lattice relationships between martensite and the parent austenite have been

*Literature references are cited by the corresponding item number in the Review of Current Metal Literature instead of repeating the entire title, author, and source. This information can be obtained by referring to *Metals Review* for the month indicated in 1949, or the 1948 bound volume of the A.S.M. Review of Metal Literature (Volume 5).

made. Greninger and Troiano (4B-89, Oct. 1949), for example, studied the lattice orientations among the austenite and martensite lattices and the martensite plates in high-carbon steel, finding a relationship somewhere between those previously reported by Kurdyumov and Sachs and by Nishiyama. They postulated a transformation mechanism involving two shears. The first shear creates a lattice with interplanar spacings and atomic positions the same as those in martensite; the second shear acting in a certain plane generates the martensite lattice.

German workers studied the relative orientations between the parent austenite and ferrite formed under stress (4B-43, June 1949), and found a new relationship with the (111) direction of austenite parallel to the (210) direction of ferrite.

The effect of applied tensile stress on the amount of martensite formed in high-carbon steel was investigated by Cohen (4b-132, 1948). Bars quenched to various temperatures below room temperature and therefore containing amounts of martensite increasing with the degree of subcooling were pulled in tension. The amount of martensite formed after the stressing was then plotted against stress. Bars quenched to 84° F. contained little martensite but began forming more of it at about 20,000 psi. The amount of martensite then increased approximately in a linear manner with continued increase in stress. However, bars quenched to 22° F. were about three-eighths martensitic at the start and did not begin to transform further until the stress reached about 110,000 psi. In the region where transformation was increasing with stress, the transformation-stress curves formed an overlapping band, indicating that the amount of transformation is more closely related to stress than to strain.

Fine austenitic grain size lowers the Ms temperature, according to experiments on an 80% Fe, 20% Ni alloy and an S.A.E. 4140 steel (4b-60, 1948). Furthermore, the spread between the Ms and Mf temperatures may be partly a grain-size effect, for as the martensite plates form they continually subdivide the austenite grain into smaller units, thereby serving to depress further the Ms point of the remaining austenite.

Harris and Cohen discovered a maximum stabilization temperature σ_s above which austenite cannot be stabilized by holding before final cooling (4b-84, 1948). The increase in the amount of retained austenite effected by this intermediate holding is proportional to the difference between σ_s and the holding temperature. The temperature σ_s depends on the alloy content of the steel and may be either above or below the Ms temperature.

Contrary to general statements of the properties of the martensitic-type reaction, austenite does decompose to martensite isothermally (4b-66, 1948). As much as 5% of retained austenite may decompose at room temperature.

J. Robert Doig is a research physicist at Battelle, where he has been engaged in the application of X-ray diffraction methods to industrial problems. He holds a B. S. from Union College and an M.S. from Penn State.

Other Transformations

Some recent investigations indicate that the pearlitic structure, though found in many alloy systems, is not universally the product of all solid solutions that decompose by eutectoid reaction. Eutectoidal alloys of the kappa phase of the Cu-Si system form no pearlite on isothermal transformation (4c-72, 1948). Likewise, hypereutectoid alloys of the beta phase of the Cu-Al system do not form pearlite (though the eutectoid alloy itself can do so). Instead, a bainitic type of reaction is observed (4C-105, Oct. 1949). In this process, the matrix first separates into aluminum-rich and aluminum-poor regions. The aluminum-rich regions decompose to form a compound phase whose particles then grow by an accretion process, depleting the matrix until finally it decomposes into alpha phase. Incidentally, it was the fortunate existence of the two martensitic phases in this system that enabled the authors (Klier and Grymko) to follow the process of the decomposition of the beta phase with unusual certainty.

Nucleation of Phase Transformations

A theory of transient nucleation, which appeared about 18 months ago, now makes it possible to explain all types of transformation in terms of nucleation and growth. This theory, first proposed by Turnbull (4a-30, 1948), also explains why an incubation period is observed in such transformations as that from austenite to pearlite or bainite, while no incubation period is necessary for martensitic transformations.

Over the past ten years or so, the isothermal transformation studies of Mehl and his coworkers established that pearlite forms by a process of nucleation and subsequent growth of the nuclei in the austenite matrix. They measured the rate of nucleation as a function of time. After the incubation period, during which no nuclei were detected, nucleation began at a low rate and gradually increased until it reached a steady-state rate.

The theory of transient nucleation, as proposed by Turnbull, is an extension of the Volmer-Becker theory which had satisfactorily explained the rate of nucleation of droplets from condensed vapor but had failed to predict the incubation period for transformations in solids until it was revised by Turnbul.. In this theory, it is assumed that there is a certain minimum or critical size of nucleus of a stable phase that is able to grow spontaneously in an unstable matrix phase. Nuclei of size smaller than this are always present because of chance arrangements of atoms, but they suffer continual fluctuation in size by gaining or losing atoms through thermal motion. Hence, they are called embryos.

For every temperature there is a definite equilibrium concentration of each size of embryo. Furthermore, the theory predicts that the rate of nucleation is proportional to the number of those embryos whose size is just smaller than the critical size. At this point, Turnbull injected his important revision that explained the incubation period. He pointed out that when the alloy is cooled from above the transformation temperature to a temperature not far below it, the equilibrium distribution of embryos does not take place immediately but requires time because the rate of growth of embryos by addition of atoms is limited by diffusion. Hence, the rate of nucleation is negligibly small at first and does not become appreciable until the concentration of embryos of near-critical size has been built up. As the distribution of embryo sizes approaches equilibrium, the nucleation rate increases until it, too, reaches a steady state.

Fisher, Hollomon, and Turnbull (4a-43, 1948) subsequently interpreted the above theory to explain the martensite transformation as a process of nucleation and growth. The Turnbull theory predicts that the critical size of nucleus required for spontaneous growth decreases with decrease in temperature. They assumed that, on quenching, the equilibrium distribution of martensite embryos existing before the quench is retained. Now, when the austenite cools sufficiently, a substantial concentration of embryos will be large enough to grow, and, as is known, the growth of martensite is rapid. If the rate of nucleation is assumed to be slow at these low temperatures, the rate of isothermal transformation of martensite will also be slow, and not much more martensite will be formed until the austenite is cooled further.

The transient nucleation theory also explains the well-known fact that slow cooling or holding within the martensite region stabilizes the austenite against further transformation. During the time spent at the low temperatures, the embryos will tend

to shrink in size toward the distribution characteristic of that temperature range. Hence, the concentration of nuclei of size required for transformation will be less than it would if they had not had time to shrink.

In a more quantitative study of transient nucleation, Hobstetter (4a-55, 1948) considered that the chemical composition of the embryos is important as well as their size, and was able to explain the shape of the C-curves in isothermal transformation diagrams. In his calculations, he assumed a definite embryo shape and a decomposition within the solubility gap in an equilibrium diagram.

Cohen's 1948 Campbell Memorial Lecture (4b-132, 1948) proposed another theory of the formation of martensite. He assumed that the martensite plates are formed by a process of nucleation and shear, and that plenty of activation centers exist to nucleate the transformation. He then pointed out that the free energy made available by supercooling has to supply the kinetic energy of the transformation as well as strain and surface energies. The transformation occurs rapidly when cooling has provided enough free-energy differential to supply these requirements, the amount transformed at any one temperature being dependent on the amount of the differential. Cohen pointed out that the existence of a maximum stabilization temperature, σ_s, dependent on alloy content is not consistent with the mechanism of austenite stabilization proposed by Fisher, Hollomon, and Turnbull.

Precipitation Hardening

Before dealing with new studies of precipitation hardening, it would be well to review the status of this subject as of two or three years ago. Douglas, in a review of all structural studies published from 1939 to 1946 (4A-122, Dec. 1949), lists four successive stages in the precipitation process. In the first stage, the solute content increases in small regions parallel to certain matrix planes. These regions of concentration are sometimes referred to as "knots" or Guinier-Preston zones. In the second stage, thin plate-like regions (or platelets) are produced which form two-dimensional diffraction gratings. These may be regarded as first consisting of superlattice structures which later change over, by simple atomic movements, to a transition structure which is coherent with (or has a precise atomic registry with) the matrix across the habit plane. In the third step, these particles, having transition (unstable) structures, grow in thickness and in lateral dimensions, in some alloys becoming only a few atoms thick, and in others attaining a size which enables the actual structure to be determined. In the final stage, the transition structure transforms to the stable precipitate structure which does not have registry with the remaining matrix. The strain resulting from the coherence or registry across the matrix-precipitate interface is the major factor involved with the observed increase in hardness. Al-Cu, Al-Ag, and Al-Mg, which form coherent transition lattice particles of considerable size, harden appreciably, but Al-Zn, Mg-Pb, and Mg-Sn, in which the coherent particles break away when very small, harden very little.

Geisler has recently discussed the changes in hardness and other properties that take place during aging (18a-23, 1948). While not actually denying the existence of the Guinier-Preston zones of the first stage of precipitation, he asserts that the earliest changes in properties are explained well enough by the early production of a coherent transition precipitate at localized regions around grain boundaries, twin boundaries, and slip bands. This is the first evidence of precipitation. The particles are too small to permit resolution of their shape in the microscope. Somewhat later, a general precipitation, also too fine to be resolved, is visible throughout the grain. But, by this time, the transition precipitate in the grain boundaries may have grown large enough to lose coherence with the matrix so that softening or overaging has already begun there. Maximum hardness in many alloys is reached before this stage.

Further aging results in still further precipitation and growth of the particles. In some alloys they can be recognized as plates forming parallel to some family of planes of the matrix in a Widmanstätten pattern. On still further aging, the precipitation can take one of two courses. The particles may merely coalesce and spheroidize. In this case, the plastic strains of precipitation are relieved by crystal recovery of the matrix. On the other hand, the matrix may recrystallize by the process of being consumed by the advancing grain-boundary reaction. In this way a lamellar precipitate is formed. This type of precipitation is called discontinuous, because there is no coherence or continuity between the matrix and precipitate.

In the general crystallographic sequence, the parent matrix becomes altered into a partially depleted matrix plus a coherent precipitate. The latter consists of a transition lattice strained into registry with the depleted matrix. Finally, the stable second phase forms and the matrix becomes depleted. Aging curves represent the net effect of hardening (resulting mostly from coherency) and softening produced by loss of coherency and by recrystallization of the matrix. Double peaks in an aging curve indicate the times at which maximum hardness is reached in localized precipitation and in general precipitation, respectively. Loss of ductility and tendency toward intergranular fracturing are attributed to localized overaging at the grain boundaries.

In addition to "platelets" of transition precipitate, "stringlets" are now observed also in the precipitation process (11-10, Feb. 1949). These stringlets are particles of precipitate whose dimensions are too small in all but one direction to be detected by X-ray diffraction. They were discovered in Al-Ag and Al-Mg-Si alloys by a new X-ray diffraction technique involving the use of Laue patterns of single crystals taken with characteristic radiation at a series of increasing angles with the X-ray beam.

In the transition structure formed during aging of the face-centered cubic matrix of the Cu-Ni-Co alloy, both precipitate and depleted matrix first assume face-centered tetragonal lattices (4c-60, 1948). The cobalt-rich precipitate has lattice constants 3.50 and 3.56Å, while the copper-rich depleted matrix has lattice constants 3.56 and 3.63Å. The transition structure then decomposes to the two stable face-centered cubic phases.

Ferrous Alloys

The literature on carbides in alloy steels is widely scattered. Goldschmidt, however, has recently compiled a comprehensive survey of the structures of these carbides and their relations in the various metal-carbon systems (4B-6, Feb. 1949). He has found a new carbide in chromium steels (4B-3, Feb. 1949). It has the structure of austenite and was first mistaken for such a constituent after it was extracted from an 8% chromium steel. However, it had a carbon content of 9.4%, slightly higher than $(Fe,Cr)_7C_3$. It has a NaCl structure like TiC, but about one-half of the carbon positions in the lattice are vacant. The new carbide (called psi phase) is expected to have commercial implications and is interesting theoretically because it bridges a gap in the series of cubic carbides of the transition metals. From TiC with a Me:C ratio of 1, the series goes through V_4C_3, psi, $(Cr,Fe)_7C_3$, $(Cr,Mn,Fe)_{23}C_6$, to austenite, with a Me:C ratio of 12.

Several groups of workers have described improved methods of extracting carbides and inclusions from steel (4B-30 and 4B-28, May 1949).

An interesting experiment was performed, bearing on the relationship between complex carbides and the sigma phase FeCr, which is well known for its embrittling effect (see discussion on 4b-26, 1948). An $(Fe,Cr)_{23}C_6$-type carbide with Cr:Fe ratio of 3:2, extracted from a Cr-Ni steel, was heated in vacuum with an intended pressure of 0.0001 mm. of air. The residue was subsequently examined by X-ray diffraction and found to be composed mainly of

(Continued on page 24)

British Steel Industry Sponsors Joint Research

Left to Right at Pittsburgh Chapter's Annual Carnegie Lecture Are Sir Charles Goodeve, Speaker; G. A. Roberts, Chapter Chairman; and Robert F. Mehl of Carnegie Tech, Who Led the Discussion

Sir Charles Goodeve Presents Andrew Carnegie Lecture Before Pittsburgh Chapter

Reported by G. A. Ratz
Vanadium Corp. of America

Sir Charles Goodeve, F.R.S., director of the British Iron and Steel Research Association, gave the second Andrew Carnegie Lecture before the Pittsburgh Chapter A.S.M. on Oct. 13. The address, titled "Cooperative Research in the British Iron and Steel Industry", inaugurated the 1949-1950 series of monthly technical meetings.

Sir Charles opened his talk by explaining the relationship between the various industrial organizations, research facilities and universities within the British Iron and Steel Research Association, and showed how they cooperate to attain a common goal. There are approximately 45 member organizations in the Association and the results of their united efforts have aided considerably in the extensive expansion of the British iron and steel industry within the past four years.

The Association has grouped the various phases of steel metallurgy into six divisions: iron making, steel making, mechanical working, steel casting, plant engineering and general metallurgy. These divisions are given various subgroupings and work is assigned to the members or laboratories best suited to handle the problems. Pure research is generally carried out in the universities, while the practical problems of applied research are studied at the industrial laboratories.

Research organizations such as the National Physical Laboratory act as connecting links between the university members and the industrial groups so that results of pure research may be put to practical uses. The British Iron and Steel Institute is the official publishing agency of the organization.

At present approximately 250 projects are being actively investigated and Sir Charles cited a few examples to illustrate the diversity of the work. One of the more recent techniques developed is the use of radioactive gases introduced into a pilot-size blast furnace to aid in determining the rate of flow and movement of gas in the furnace during operation.

Income of Metallurgists Tops Engineering Groups, National Survey Shows

Metallurgy is the highest paid of the engineering professions. This fact was established as a result of a recent national survey conducted by the American Society for Metals from its headquarters in Cleveland.

The survey, first of its kind, also classified the professional metallurgist as to his title, class of work, responsibility over others, distribution of time, products made by his company, as well as salary bracket at different periods of employment.

This occupational analysis of the metallurgical profession, conducted by the metalworking industry's basic society, establishes for the first time a separately defined status for the metallurgist. Previous statistics on this important member of the engineering profession have been in conjunction with mining engineers or other groups.

Significant results were obtained from this nationwide investigation of the metallurgist's professional standing. More than 50% of the metallurgists among the Society's 20,000 members were circularized. The questionnaire sought answers to specific questions about the metallurgist's background and his contribution to our industrial progress. A gratifying 30% of those questioned replied. Analysis of the survey brought to light the following facts:

Income: The average income for metallurgists, according to the A.S.M. analysis, is $6567. The national average income for all types of engineering, according to the U. S. Bureau of Labor Statistics, is $4668. Comparisons with other professional incomes are equally impressive. The lawyer receives an average of $5719; the chemical engineer's annual average is $4320. The average yearly income of all college graduates in the U. S. is $4689, while the average yearly pay of all U. S. workers is $2840.

Three factors were shown to affect a metallurgist's income—his responsibility, his college or technical training, and the length of time on the job.

Responsibility—Aside from 6.5% of those queried who had succeeded to administrative and sales positions, the responsibility of metallurgical control over quality and production offers the highest income—a high of $35,000, with an average of $7221.

Technical Training—With a bachelor's degree, the metallurgist's income averages $6601. A master's degree justifies $6877. A doctor's degree gives $9122.

Length of Service—One year after graduation metallurgists draw an average income of $3700. After five years, the average goes to $5500, and after ten years to around $6500. In 20 years the metallurgist averages $8100, and the peak income averaging $9000 is reached in 30 years.

Work Categories: 32% of those responding were employed by producers of basic metals; 51% worked in industries which fabricate metals into finished products or parts, and the remainder were engaged in various services to the industry.

Class of Work: 40% were concerned with technical problems of production; 32% were engaged in technical research or development, and the remaining 28% were concerned chiefly with technical contacts, management and distribution.

Titles: A majority of those questioned—61%—gave their title as metallurgist, and 11% of this number were identified as *chief* metallurgists. Material engineers accounted for 7% of the replies, while 4% were production engineers. Supervisors, superintendents, foremen and other operating personnel made up the balance.

Distribution of Time by Activities: Only in technical duties did any of the respondents devote all of their time—31% of the total. All of those questioned spent some of their time in this field. Only a single reply indicated less than 11% time in this activity.

A.S.M. Annual Meeting

Reports of the President, Secretary and Treasurer; Election of Officers

THE ANNUAL MEETING of the American Society for Metals was held in Cleveland on Wednesday morning, Oct. 19, during the National Metal Congress and Exposition.

President Work presented the slate of new officers nominated last May (see *Metals Review*, June 1949). No additional nominations having been received, the secretary cast the unanimous vote of the members for these candidates.

Annual reports of the president, treasurer and secretary were presented, and are reproduced in summary below. They will be published in full in the next volume of the A.S.M. *Transactions*.

PRESIDENT'S REPORT

Presented by Harold K. Work

Director, Research Div.
New York University
College of Engineering
Retiring A.S.M. President

. . . This year the theme of the National Metal Congress is "Economy in Production". The appropriateness of this theme will be reflected throughout this review of the past year in A.S.M.

. . . We have 20,345 members and 77 chapters as of Sept. 1. One of the important activities of your officers is to visit these chapters. . . . With the growth of the Society and the addition of new chapters from year to year, however, the burden on your president and secretary has become increasingly great. . . . To remedy this, your secretary has suggested having as many as possible of the national officers give talks before chapters. This year your president and the other officers (excluding your secretary who ordinarily visits the chapters with one of the other officers) appeared before a total of 57 chapters. . . . In addition to these chapter visits, your national officers held four board meetings on Oct. 29, 1948, April 12, 1949, Aug. 19, 1949, and Oct. 18, 1949.

A particularly valuable part of the visits to the chapters consisted of the frank discussion between the chapter officers and the national officers of matters of Society business. . . . This type of discussion is without doubt one of the strongest factors in directing work of your officers to best meet your needs.

. . . Some 16,000 members returned their old Handbooks and received new copies in exchange. In addition, approximately 5000 copies have been sold. . . .

The treasurer will soon present the financial report of the Society and, as usual, it will be favorable. Your Society, however, has been able to maintain its dues constant and there has been no resorting to special levies. We have continued in the black. In addition, over the last two or three years your Society has absorbed charges amounting to about a quarter of a million dollars resulting from the publishing of the Metals Handbook.

Carrying this thought a little further, it is interesting to note that membership dues represented only about 20% of the total income of the Society. More than half of this, however, was applied to chapter activities in one way or another. Furthermore, the Society spent approximately $42 for each membership—a rather impressive figure. Stated in another way, if the Society had no other sources of income, dues of $42 per year would be needed to provide the current service to the members.

The question is frequently asked as to why A.S.M. is building up a substantial reserve fund. It has been the feeling of your officers that A.S.M. should have a reserve equal to about three times its annual operating rate. This would carry the Society through any prolonged and serious depression. I think you will agree that the current difficulties in other technical societies, with which many of us are familiar, bear out the contention that A.S.M. has been wise in pursuing a conservative financial policy.

The financial side of the picture, however, tells only a part of the story of the works of your Society. Take, for example, the Handbook. While it cost about $8 per copy to print and mail, there is no inclusion in this figure of any value for the thousands and thousands of man-hours contributed to this publication by the members themselves. . . .

. . . Both the National Metal Congress and the Western Metal Congress have proved successful as educational projects. The Expositions have also proved successful both from their benefit to the industry and as financial propositions.

During the past year, the first book of a series of tech books has been produced. It discussed the subject of magnesium. . . .

. . . In view of the rapid advance of television and the uncertainty of the possible future of an FM station, the acquisition of such a broadcasting station by A.S.M. for educational purposes is being approached with the greatest of caution. At the moment it is not possible to say whether it would prove desirable to go ahead with this.

During the last Metal Congress the President's Medal was awarded to Mr. A. L. Boegehold. The Howe Award was given to Mr. J. W. Spretnak. The American Society for Metals Gold Medal award was conferred on Dr. Francis C. Frary, director of research of the Aluminum Co. of America, and the American Society for Metals Medal for the Advancement of Research was conferred on the late Dr. Willard H. Dow, president of the Dow Chemical Co. The 1948 Campbell Lecture was given by Morris Cohen of the Massachusetts Institute of Technology. . . .

TREASURER'S REPORT

Presented by E. L. Spanagel

Engineer, Industrial Department
Rochester Gas & Electric Corp.
Retiring A.S.M. Treasurer

Your Society's fiscal year, ending on Aug. 31, 1949, has been another very successful year. . . .

The cash assets show an increase of $151,672.22 as compared to that of a year ago. Security holdings of the Society increased by $67,796.09 within the past year. The principal changes in the investment portfolio involved the sale of certain U. S. Government Bonds and the use of the proceeds therefrom together with surplus funds to purchase other U. S. Government Bonds, effecting an improvement in the maturity schedule of the government holdings. Rights were also exercised to purchase additional shares of common stocks in Columbia Gas System, Inc., Pacific Gas & Electric Co., Cleveland Electric Illuminating Co., and debenture bonds in American Telephone & Telegraph Co. As has been customary since 1931, all investments were made on recommendation of the Society's fiscal agents, the Cleveland Trust Co., with whom the Finance Committee and the Board of Trustees keep in constant touch so as to maintain a close contact with the investment market. . . .

As of Aug. 31, 1949, the Society's investments had a market value of approximately $1,448,054. Interest and dividends earned on the above investments amounted to $50,309.81, or 3.65% this year, as compared to $47,141.58 and 3.60% for the previous year.

In addition to the cash assets and the investments in securities, the Society's assets included real estate rep-

resented by the National Headquarters carried at $60,658 and inventories in books, furniture and equipment totaling $169,017. The total assets of the Society, at $2,064,700.21, show an increase of $220,651.52 or 12% over the total as of a year ago.

It is of interest to note also that the combined assets of the local chapters now total approximately $200,000. The various chapters are thus in position to assure a continuance of their respective activities in the promotion of the aims of the Society. . . .

The income from *Metal Progress*, together with the income from the Metal Expositions, representing about 60% of the total income of the Society, are obviously very important factors in the over-all net gain for the year.

Gross income from membership dues this past year amounted to $221,140.69. Of this amount, $90,288-.43 was returned to the chapters. . . .

Transactions and *Metals Review* are not self-sustaining, and hence cost the Society net sums of approximately $30,392 and $45,215 respectively.

Sale of books published, including the Metals Handbook and The Review of Metal Literature, resulted in approximately $30,350 excess income over expenses. In addition, $29,377 was placed in our reserves account, allocated to the publication of the next revision of the Metals Handbook. A total of about $50,000 is now set aside for this purpose. . . .

SECRETARY S REPORT

Presented by W. H. Eisenman

Secretary
American Society for Metals

The American Society for Metals on Oct. 1, 1949, had a total membership of 20,370. Of this number, 17,267 or 84.8% were of the member classification; 1669 or 8.2% were sustaining members; while 1399 or 6.9% were junior members. There were 35 honorary and founder members.

Transactions—Vol. 41 and Vol. 41A of the *Transactions* were published and distributed to the membership in May 1949. Vol. 41 totals 1451 pages and constitutes 50 articles with their discussions. It contains all of the papers presented at the October 1948 Convention held in Philadelphia together with the interim papers received during the year . . .

Vol. 41A contains the 18 papers (364 pages) presented at the seminar on "Cold Working of Metals" held on Saturday and Sunday, Oct. 23 and 24, 1948, during the National Metal Congress and Exposition, Philadelphia. This seminar was sponsored by the American Society for Metals, the subject being selected by a committee appointed by the Board of Trustees.

Metal Progress—Statistics of editorial production, advertising volume and income and expense for your monthly magazine, *Metal Progress*, may be summarized as follows:

Total of editorial pages for fiscal 1949 was 620.6, average for the 19 years since the magazine was established.

Total advertising volume for fiscal 1949 was 1356.8 pages.

Total circulation has remained steady for the last four years, the monthly print order averaging about 23,500 copies . . .

Assignment of Taylor Lyman, full time as associate editor since Jan. 1, 1949, has greatly increased the editorial potential. A shorter average length of article has improved the editorial coverage. Notable items of editorial content during the year have been the numerous brief biographies of metallurgists of note—especially those who received the A.S.M.'s Distinguished Service Awards at the last convention for meritorious contributions to progress in alloy steels. Likewise there has been a large increase in the space devoted to abstracts of European literature. The editor's "Critical Points" (his observations of noteworthy happenings in the field of metallurgy near and far) continue to receive high praise from the readers . . .

In an effort to determine the effectiveness of the magazine, two questionnaires were circulated early this year to two equivalent samples of members, selected and balanced by scientific methods. One was sent from the Society's general office and the other from the Commercial Research Bureau of Cleveland. Results of these two surveys were practically identical . . . From these surveys it is definitely proven that each member of the Society spends, on the average, 1½ hr. in reading *Metal Progress*, dividing his attention about equally between advertising and editorial pages . . .

Further information gained in the above-mentioned survey established definitely that 88% of the readers of *Metal Progress* specify, recommend or purchase equipment or supplies, and 78% have acted on advertisements read in *Metal Progress* . . .

Metals Review—During the past 12 months *Metals Review* has carried regularly four feature sections: a special article reviewing the literature in a specific field of metallurgy, a section devoted to A.S.M. national and chapter news, the Review of Current Metal Literature, and the section headed "New Products in Review".

The special literature survey articles have covered such diversified and timely subjects as nodular graphite, high-temperature metals, powder metallurgy, electroplating, the less common metals, heat treating, welding, and corrosion . . .

In the A.S.M. news section, the 77 chapters of the American Society for Metals have contributed 249 reports of their meetings and activities during the 12-month period . . .

The Review of Metal Literature has continued to expand its coverage until now an average of 900 technical articles and books are abstracted in each monthly issue.

An offshoot of this activity was the formation last January of a Literature Classification Committee sponsored jointly by the American Society for Metals and the Special Libraries Association . . .

Metals Handbook—The 1948 edition of the Metals Handbook has now been available for more than a year, and reviews of the new edition have been published by a number of European journals. These reviews have been uniformly complimentary . . .

The Metals Handbook Committee, under the chairmanship of J. B. Johnson, held one meeting during the past year. The Committee is considering general policies relating to the scope and size of the next edition . . .

Books—During the past fiscal year, a total of 19,360 books published by the Society were sold to members and others. This figure includes 3,180 copies of the 1948 Metals Handbook.

During this period eleven titles were added to the publication list. These are:

Transactions of the ASM, Vol. 41; ASM Review of Metal Literature, Vol. 5; A Brief History of Alloy Steel, by C. A. Zapffe; The Story of Magnesium, by W. H. Gross; Sleeve Bearing Materials, by 20 authors; Physical Metallurgy of Aluminum Alloys, by five authors; Properties of Metals in Materials Engineering, by eight authors; Metallurgy and Magnetism, by J. K. Stanley; Grain Control in Industrial Metallurgy, by four authors; Cold Working of Metals, by 20 authors; Stainless Steels, by C. A. Zapffe.

The following titles are now in preparation:

Mechanical Wear (a symposium held at M.I.T.), by 22 authors; Machining—Theory and Practice, by 15 authors; Melting of Copper Alloys, by Daniel R. Hull; Heat Treatment in Controlled Atmospheres, by Floyd Harris.

You may be interested to know that your Society is the largest publisher in the world of books for the metals industry.

The Publications Committee for the year 1948-49 . . . (R. H. Aborn, chairman) . . . reviewed 68 papers, which included ten papers presented at the 1949 Western Metal Congress. Of the 68 papers considered, 36 were approved for presentation at this Convention. . .

The Publications Committee held one formal meeting on June 8 and 9, 1949 . . .

Preprints—Of the 36 papers being presented at this convention, 35 were prepared in preprint form and distributed to those members of the Society who requested them. The number of pages in the 1949 preprints is 869. A total of 40,000 preprint copies was distributed free to members.

The Educational Committee for the year 1949 . . . (H. B. Knowlton, chairman) . . . held one formal meeting on Feb. 2, 1949, at which time the two educational lecture courses for the 1949 convention were selected and planned. These lectures are: "Machining—Theory and Practice", by 15 authors . . . and "Stress Corrosion in Metals", by three authors . . .

The Seminar on Thermodynamics in Physical Metallurgy this year was a great success—five important and interesting sessions—with the meeting room filled to capacity. M. Gensamer, Carnegie-Illinois Steel Corp., Pittsburgh, was chairman, and C. Zener, Institute for the Study of Metals, University of Chicago, was coordinator of the seminar.

Metal Congress—The outstanding National Metal Congress now in session speaks for itself to all those in attendance . . . The officers and trustees and the members of the Society express their sincere appreciation for the cooperation received and the splendid programs prepared not only

by their own A.S.M. committees but also by the American Welding Society, the Institute of Metals Division of the Metals Branch of the American Institute of Mining and Metallurgical Engineers, and the Society for Non-Destructive Testing.

It has been the interest and programs of these four great technical societies that make the Metal Congress the mecca for the top-flight metals engineers of the world.

This Congress and Exposition has also been recognized by top Government officials.

The Exposition—At the time the floor plans were being sent out for this Exposition the question of increasing the efficiency of the annual exposition received serious consideration. It was then decided that the theme of the Congress and Exposition should be based on the thought uppermost in the minds of all metal industries, which was to reduce costs by means of economies in operations . . .

Some 350 metal-producing and metalworking firms are participating in a demonstration of the economy producing advantages of their products and services to the 45,000 visitors.

This group of exhibitors will occupy the greatest amount of space that has ever been used for a display of the metals industry.

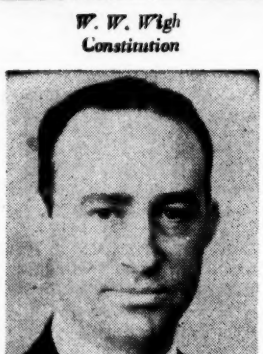
Appointments to A.S.M. Standing Committees

At the meeting of the Board of Trustees of the American Society for Metals held Oct. 21, new appointments to the various national committees of the Society were announced by President Focke and confirmed by the Board. The complete personnel of the standing committees is listed below. The new appointments are shown in italics and the numerals represent the date of expiration.

W. W. Wigh
Constitution

J. F. Kahles
Educational

C. Zener
Seminar



J. W. W. Sullivan
Advisory Education

New Chairmen of

Standing Committees

A. R. Troiano
Publication

Advisory Committee on Metallurgical Education

John W. W. Sullivan, American Iron and Steel Institute, New York City, Chairman '50.
Alfred Bornemann, Stevens Institute of Technology, Hoboken, N. J., '51.
John Chipman, Massachusetts Institute of Technology, Cambridge, Mass., '51.
H. P. Croft, Metals Research Associates, Inc., Cleveland, '50.
James Gregg, Cornell University, Ithaca, N. Y., '51.
M. A. Hunter, Rensselaer Polytechnic Institute, Troy, N. Y., '50.
F. M. Klayer, Tube Turns Inc., Louisville, Ky., '52.
V. N. Krivobok, International Nickel Co., New York City, '52.
C. K. Lockwood, Shawinigan Chemicals Ltd., Montreal, Quebec, '52.
W. O. Philbrook, Carnegie Institute of Technology, Pittsburgh, '52.

Metal Progress Advisory Committee

E. E. Thum, Editor, Metal Progress, Cleveland.
A. E. Focke, President, A.S.M.
Walter Jominy, Vice-President, A.S.M.
W. H. Eisenman, Secretary, A.S.M.
Ray T. Bayless, Assistant Secretary, A.S.M.
Albert W. Demmler, Campbell, Wyant and Cannon Foundry Co., Muskegon, Mich., '52.
O. W. Ellis, Ontario Research Foundation, Toronto, '50.
Muir L. Frey, Allis-Chalmers Mfg. Co., Milwaukee, '52.
J. D. Hanawalt, Dow Chemical Co., Midland, Mich., '51.
L. A. Lindberg, Lindberg Steel Treating Co., Chicago, '50.
Howard Scott, Westinghouse Electric Co., East Pittsburgh, Pa., '51.

Educational Committee

J. F. Kahles, University of Cincinnati, Chairman '50.
Ray T. Bayless, A.S.M., secretary.
R. H. Aborn, U. S. Steel Corp., Kearny, N. J., '50.
M. J. Day, Carnegie-Illinois Steel Corp., Pittsburgh, '52.
K. L. Fetters, Youngstown Sheet & Tube Co., Youngstown, Ohio, '51.
N. J. Grant, Massachusetts Institute of Technology, Cambridge, Mass., '51.
H. Y. Hunsicker, Aluminum Co. of America, Cleveland, '52.
I. R. Kramer, Office of Naval Research, Washington, D. C., '52.
Charles L. Lewis, Cook Heat Treating Co., Houston, Texas, '51.
Ray McBrian, Denver and Rio Grande Western Railroad Co., '52.

Seminar Committee

Clarence Zener, Institute for the Study of Metals, University of Chicago, Chairman, '50.
J. B. Austin, U. S. Steel Corp., Kearny, N. J., '50.
R. M. Brick, University of Pennsylvania, Philadelphia, '50.
Morris Cohen, Massachusetts Institute of Technology, Cambridge, Mass., '50.
M. Gensamer, Carnegie-Illinois Steel Corp., Pittsburgh, '50.
John H. Hollomon, General Electric Co., Schenectady, '50.
L. R. Jackson, Battelle Memorial Institute, Columbus, Ohio, '50.
L. K. Jetter, Oak Ridge National Laboratory, Oak Ridge, Tenn., '50.
Don M. McCutcheon, Ford Motor Co., Dearborn, Mich., '50.

Constitution and By-Laws Committee

William W. Wight, Pratt & Whitney Division, West Hartford, Conn., Chairman '50.
W. J. DeMauriac, Philadelphia Electric Co., Philadelphia, '51.
F. A. Forward, University of British Columbia, Vancouver, B. C., '51.
E. J. Hergenroether, International Nickel Co., Detroit, '52.
A. S. Jameson, International Harvester Co., Chicago, '50.
F. J. Robbins, representative of the Board of Trustees.
Gilbert Schaller, University of Washington, Seattle, Wash., '52.

Metals Handbook Committee

J. B. Johnson, Wright-Patterson Air Force Base, Dayton, Ohio, Chairman '50.
Taylor Lyman, A.S.M., secretary.
Howard S. Avery, American Brake Shoe Co., Mahwah, N. J., '50.
R. M. Brick, University of Pennsylvania, Philadelphia, '50.
Walter Crafts, Union Carbide & Carbon Research Laboratories, Niagara Falls, N. Y., '52.
E. S. Davenport, U. S. Steel Corp., Pittsburgh, '50.
E. O. Dixon, Ladish Drop Forge Co., Cudahy, Wis., '50.
Bruce W. Gonser, Battelle Memorial Institute, Columbus, Ohio, '51.
Max Hansen, Illinois Institute of Technology, Chicago, '51.
R. L. Kenyon, Armco Steel Corp., Middletown, Ohio, '50.
Peter Payson, Crucible Steel Co. of America, Harrison, N. J., '51.
R. E. Van Deventer, Packard Motor Car Co., Detroit, '52.

Publications Committee

A. R. Troiano, Case Institute of Technology, Cleveland, Chairman '50.
Ray T. Bayless, A.S.M., secretary.
W. M. Baldwin, Jr., Case Institute of Technology, Cleveland, '51.
John A. Bennett, National Bureau of Standards, Washington, D. C., '52.
Edgar Brooker, United States Spring & Bumper Co., Los Angeles, '51.
C. K. Donoho, American Cast Iron Pipe Co., Birmingham, Ala., '51.
C. T. Evans, Jr., Elliott Co., Jeannette, Pa., '50.
M. G. Fontana, Ohio State University, Columbus, Ohio, '50.
A. J. Herzig, Climax Molybdenum Co., Detroit, '51.
E. I. Larsen, P. R. Mallory & Co., Inc., Indianapolis, '52.
W. E. Mahin, Armour Research Foundation, Chicago, '51.
W. A. Pennington, Carrier Corp., Syracuse, N. Y., '50.
Glen C. Riegel, Caterpillar Tractor Co., Peoria, Ill., '52.
George A. Roberts, Vanadium-Alloys Steel Co., Latrobe, Pa., '52.
H. Solakian, John Ek Industries, Inc., Guilford, Conn., '50.
L. P. Tarasov, Norton Co., Worcester, Mass., '52.
C. A. Zapffe, Baltimore, Md., '50.

Finance Committee

Ralph Wilson, Timken Roller Bearing Co., Canton, Ohio, Chairman (A.S.M. Treasurer).
J. B. Austin, U. S. Steel Corp. Research Laboratories, Kearny, N. J., '51.
Zay Jeffries, General Electric Co., Pittsfield, Mass., '50.
R. S. Lynch, Atlantic Steel Co., Atlanta, Ga., '52.
A. W. Mace, Allegheny Ludlum Steel Corp., Washington, D. C., '50.
E. H. Stilwill, Dodge Division, Chrysler Corp., Detroit, '50.
K. R. Van Horn, Aluminum Co. of America, Cleveland, '52.
L. C. Whitney, Copperweld Steel Co., Glassport, Pa., '51.

Ductile Iron Comparison Shows How Properties And Structure Are Altered

Reported by Claude L. Rohrbaugh
Metallurgist, Navy Ordnance Plant

A comparison between regular cast iron and "ductile iron", presented before the York Chapter A.S.M. on Oct. 12, showed how differences in graphite structure and physical properties are obtained. Speaker was William H. Sparr, metallurgist of the development and research division of the International Nickel Co.

Gray cast iron consists of graphite flakes dispersed throughout a steel matrix, the speaker explained. The graphite flakes are equivalent to notches and voids, and can lower the tensile strength and ductility of the matrix as much as 75%. Addition of magnesium or a magnesium-bearing alloy will produce a spheroidal graphite of crystalline structure, with consequent higher strength and ductility.

In the resulting ductile iron, high carbon is desirable for castability, particularly since the properties are not appreciably affected over a spread of 2.5 to 4.0% carbon.

Machinability of the two irons is about equivalent at the same hardness levels, but ductile iron gives a smoother surface. Wear and weldability are about equal at the same chemical composition. The material can be easily produced in any well-controlled foundry, generally following the gating and risering practice for low-carbon high-strength iron.

A range of structures and physical properties can be obtained by control of the chemistry, cooling rate, or heat treatment. Tensile strength may vary from 70,000 to 170,000 psi., elongation from 25.0 to 0.5%, hardness from Brinell 160 to 420.

Ductile iron has already been made for various machinery parts and for rolls in rolling mills, and anvil blocks in forging hammers. While the speaker had no figures on the cost of production, the discussion revealed that it is estimated to be about 10% higher than ordinary iron.

THIRTY YEARS AGO

After a short life as independent organizations, the Steel Treating Research Society and the American Steel Treaters Society merged in 1920 to form the present American Society for Metals. The early issues of the official publications of these two societies (1917-1920) are filled with nostalgic and historical associations.—Ed.

—30—

The first honorary membership in the society was conferred on SIR ROBERT HADFIELD of London in May 1919. The membership was given in recognition of his valuable contributions to the science of heat treating.

—30—

At a regular monthly meeting of the Chicago Chapter C. U. SCOTT delivered a paper on "The Heat Treatment of High Speed Steel". (For a biographical appreciation of this "dean of American heat treaters", see *Metal Progress* for May 1948, p. 677.)

—30—

Over 175 members braved inclement weather to launch the New York Chapter at its first meeting. W. H. EISENMAN was the principal speaker; his subject—heat treating, of course!

—30—

In his introductory remarks to a discussion on "Radiometallography" SIR ROBERT HADFIELD mentions pioneering work done by H. S. RAWDON, well-known Bureau of Standards metallurgist who died recently.

—30—

A Cleveland Chapter meeting featured a topical discussion on annealing. Contributors were R. S. ARCHER of Aluminum Castings Co. (now vice-president of Climax Molybdenum Co. of New York, and a past national president), C. W. SIMPSON of Standard Parts Co. (now deceased), and J. V. EMMONS, then metallurgist and now chief metallurgist for Cleveland Twist Drill Co.

—30—

A heat treatment chart, courtesy of W. S. ROCKWELL CO., "embodies in compact form the factors that are ordinarily involved in the heat treatment of steel". These factors include heat colors in the 900 to 1700° F. range, temper colors in the 420 to 620° range, the critical range diagram for carbon steels, with brief indications of the effects on critical points of nickel, chromium and manganese, and the trade classifications and uses of steels of varying carbon content.

8½% Ni Provides Low-Cost Steel for Low Temperatures

Reported by Melvin R. Meyerson
Metallurgist
National Bureau of Standards

An "up-and-coming" new steel was described before the Washington Chapter A.S.M. on Oct. 10 by T. N. Armstrong of the International Nickel Co., Inc. This steel, the 8½% nickel steel—or more commonly characterized as 9% nickel—had its beginning only a few short years ago when an engineering firm had need for a low-cost material suitable for temperatures in the liquid nitrogen range. Copper, monel, and nickel would be suitable, but they were too expensive.

The properties of the 3% nickel steel were erratic below 150° F. and the 5% alloy was not much better—in fact, its weldability and working properties were not as good. Steels with more than 10% nickel were not considered because of prohibitive cost.

At 7½% nickel, however, peculiar effects were noticed which did not vary greatly with further increase to 10%. The impact transition temperatures of the steels decreased as more nickel was added, but at about 7% nickel the decrease leveled off. Further improvement was noted in the 8½% composition.

A special heat treatment to obtain optimum properties at liquid nitrogen temperatures consists of a double normalizing treatment followed by a reheat to 1050° F. After normalizing, the steel contains some austenite, ferrite and carbide in the form of martensite. When heated to 1050° F., carbon goes into solution with the austenite, forming a ferrite matrix with islands of high-carbon austenite which contain sufficient nickel and carbon to keep them austenitic down to liquid nitrogen temperature. If reheated above 1100° F., some of the ferrite goes into the austenite, thereby diluting it to the detriment of the steel's low-temperature properties.

Other tests were made in addition to impact. The tensile test was found to be of small value in determining embrittling temperatures. An increase in mass lowered both impact and tensile properties slightly, but this was attributed largely to an absence of hot work in the larger pieces. The steel was found to have little advantage over other steels in notched-bar fatigue tests although in smooth specimens they were quite good.

The welding of 8½% nickel steel has presented a problem. None of the low-alloy steel electrodes were suitable and attempts to produce an electrode with the same composition as the steel have been unsuccessful. Type 310 stainless electrode has been used most frequently, but is not perfect. Other materials used successfully are a modified Inconel termed R38C and a nickel-copper alloy called 140 Monel.

In determining the effect of long-time exposures at low temperatures, impact properties were found to be dependent on the temperatures, but not on the length of time held at temperature.

Other important features of 8½% nickel steel are its resistance to corrosion in oil well applications such as sucker rods (8½% nickel steel is not considered a corrosion resistant material), its unusually good wetting properties for soldering, and its high combination of tensile strength and ductility.

Texans Hear About Toolsteel Failures

Snapped at the October Meeting of the Texas Chapter A.S.M. Are (Left to Right): D. Q. Bowman, Vice-President and District Manager, Earle M. Jorgenson Co.; J. Y. Riedel, Toolsteel Engineer, Bethlehem Steel Co., and Principal Speaker; Harold Schmid, Vice-President, General Metals Corp., and Vice-Chairman, Texas Chapter; and Paul A. Anderson, District Manager, Bethlehem Steel Co. Mr. Riedel's talk on toolsteel failures is outlined on page 19. (Reported by Leland V. Dolan)

St. Louis Sponsors Course

Reported by H. O. Nordquist
Joseph T. Ryerson & Son, Inc.

A record enrollment of 165 signed up for the famous Bates course on "Fundamentals of Ferrous Metallurgy" currently being sponsored by the St. Louis Chapter A.S.M. The series of seven lectures following the text is being presented by leading metallurgists of the St. Louis area.

Lecturers include N. M. Peukert, General Steel Castings Co.; Guy White, Granite City Steel Co.; Frank Hahn, Scullin Steel Co.; Neil Waterbury, Owens-Illinois Glass Co.; Ballard Yates, McQuay-Norris Mfg. Co.; Carl Weber; and R. Tittle, Owens-Illinois Glass Co.

The response of industry to the course has been most gratifying, several companies sending as many as 19 men to attend the series.

Technical Papers Invited

The Publications Committee of the A.S.M. will now receive technical papers for consideration for publication in the 1951 *Transactions*. A cordial invitation is extended to all members and nonmembers of the A.S.M. to submit technical papers to the society. Many of the papers approved by the committee will be scheduled for presentation on the technical program of the 32nd National Metal Congress and Exposition to be held in Chicago, Oct. 23 to 27, 1950. Papers that are selected for presentation at the Conventior will be preprinted and manuscripts should be received at A.S.M. headquarters office not later than April 15, 1950.

Manuscripts in triplicate, plus one set of unmounted photographs and original tracings, should be sent to the attention of Ray T. Bayless, assistant secretary, American Society for Metals, 7301 Euclid Ave., Cleveland 3, Ohio.

Headquarters should be notified of your intention to submit a paper, and helpful suggestions for the preparation of technical papers will be sent.

High Speed Gas Heat Utilized for Forging And Heat Treating

Reported by A. H. Rauch
Metallurgist, Deere and Co.

The basic contribution that made rapid, direct heating with gas possible in the forging and heat treating industries was the development of ceramic burners, according to Charles A. Turner, Jr., metallurgist, Selas Corp. of America. Mr. Turner addressed the October dinner meeting of the Tri-City Chapter A.S.M.

Ceramics accelerate the combustion reaction and reduce the amount of space required for combustion. Furthermore, the refractory surfaces retain contour and dimensional specifications under long periods at high temperature, and a minimum of heat is conducted away by the burner body.

Mr. Turner described two basic types of burners. In the slot type, combustion occurs along the walls of a ceramic cell, which has a restricted outlet. The products of combustion leave the outlet at about 3000° F., with a velocity up to 1400 ft. per sec., and impinge upon the work at close range. Over 45,000 B.t.u. is liberated per hr.

The second type of burner is designed to transmit a large portion of the heat by radiation. It is cup-shaped, and the cavity is heated to incandescence by the combustion process. The surface temperature of the cup can be maintained as high as 2850° F. In addition to radiation, convected heat is also transmitted to the work by the hot products of combustion.

In addition to reducing cost, increasing production and reducing required floor space, high speed gas heating has improved the quality of the product. Rapid heating to the forging temperature reduces scaling and decarburization, with consequent decreased metal loss, better die life and less friction between work and dies. Greater temperature uniformity has eliminated internal cracking on all types of steel up to 6 in. in diameter, he said.

The improvement in metal flow or forgeability was illustrated by slides of samples subjected to a hot penetration test. A tungsten carbide penetrator is forced into a steel slug at forging temperatures for a period of 2 sec. Samples were heated to the same temperature by rapid heating and by simulated conventional furnace methods. Fast heating resulted in approximately 25% greater penetration.

Mr. Turner showed typical applications of high speed heating to hardening and tempering treatments, as well as the annealing of stainless steel tubing. While he emphasized the advantages and benefits of the process, he also recognized its limitations. Two limiting factors are the size and shape of the piece to be heated, and the requirement of time to complete some reactions in metal treating.

Preceding the technical lecture, Henry Hermann, general manager of the Bear Mfg. Co., delivered an interesting coffee talk on the balancing of railroad car wheels so as to minimize vibration.

NEW FILMS

A new film entitled "Iron-Carbon Alloys" has been produced by the American Society for Metals under the supervision of the A.S.M. Committee for Visual Education. It is available for showing at chapter meetings on request to A.S.M. headquarters at 7301 Euclid Ave., Cleveland 3.

The subject is introduced by showing the wide use of the alloys of iron and carbon in modern life and industry. The great variation in the properties of the different alloys, with but small changes in the carbon content, is then vividly demonstrated.

The film tells how the iron-carbon equilibrium diagram can be used to explain the profound effect that carbon has on the properties of iron. Uses of the tools of metallurgical research, such as the microscope, recording pyrometer, dilatometer and other apparatus, are described.

The formation and transformation of the structures which are produced in the iron-carbon alloys as they are heated and cooled are shown by animated diagrams, drawings and actual photomicrographs. The mechanism of the crystallographic changes from one allotropic form of iron to another is demonstrated by animated models.

The picture concludes with an affirmation of the vital importance of the alloys of iron and carbon in the building of our modern civilization.

Silver Brazing

"Production Brazing With Low-Temperature Silver Alloys" is the title of a new film to be released by Handy & Harman. It will be available for showing shortly after the first of the year. Requests should be addressed to James C. Powers, Jr., director of training, Handy & Harman, 82 Fulton St., New York 7, N. Y.

Foundry Practices

The Naval Research Laboratory has available for loan three 16-mm. sound Kodachrome films dealing with the gating of castings. The titles are "Gating Systems for Metal Casting", "Finger Gating", and "Step Gating". The films have been prepared by William H. Johnson and William O. Baker of the metallurgy division of the Laboratory. The total running time of the three films is approximately 70 min.

Requests for loan should be addressed to William S. Pellini, head, metal processing branch, metallurgy division, Naval Research Laboratory, Washington 20, D. C.

Story of Zinc

The story of zinc is dramatized in a new 34-min. sound motion picture entitled "Zinc—Its Mining, Milling and Smelting". The film is sponsored by the St. Joseph Lead Co. in cooperation with the United States Bureau of Mines and is produced by the Atlas Film Corp. It is available for distribution to schools, colleges, scientific and technical societies and other organizations, through the film library of the United States Bureau of Mines at Pittsburgh.

Speaker Available

An illustrated lecture, complete with 50 slides, on industrial diamond tools has been prepared by Harry L. Strauss, Jr., of National Diamond Laboratory, 108 Fulton St., New York 7. Requests for presentation of the lecture before local chapter meetings should be addressed direct to Mr. Strauss.

Low-Cost A.C. Welders Predicted for Future

Reported by L. Wiley Cooper
Iowa State College

"Any great increase in fabrication by arc welding will come as the result of the development of superior, low-cost alternating current welding machines", according to J. W. Shugars, district manager of Lincoln Electric Co., who spoke before the Des Moines Chapter at its first fall meeting.

Mr. Shugars went on to explain that the main difficulty with alternating current machines has been the difficulty of striking the arc, but this has been eliminated by several different types of arc boosters. Outstanding improvements to be expected in the near future, he said, include improved a.c. electrodes, along with a reduction in cost of the transformer-type welding machine.

To give an over-all view of the type of electrodes available, he presented a simplified classification chart dividing the rods in classes, using the Lincoln Electric class numbers 5, 7 and 11. These represent straight-polarity, reversed-polarity and the so-called special "hot" rods, respectively. Since each of the numerous types could vary in deposit characteristics, Mr. Shugars stressed the need of care in selecting the correct type of electrode for any given production job.

Naujoks With Ladish

Waldemar Naujoks, Author of the Popular "Forging Handbook" and Past Chairman of the Cleveland Chapter A.S.M., Has Joined Ladish Co., Cudahy, Wis., as Special Projects Engineer. He will be engaged in the development of ferrous and nonferrous alloy forgings

Massive Castings and Equipment Seen in Tour Of Worthington Plant

Reported by G. F. Kappelt
Metallurgist, Bell Aircraft Corp.

After covering 28 acres of ground and 800,000 sq. ft. of floor space, the members of the Buffalo Chapter A.S.M. were satisfied that they had seen the Buffalo Works of the Worthington Pump and Machinery Corp.

Prior to the tour, the members were prepared for the long journey by a turkey dinner in the plant cafeteria, and a few introductory remarks by A. C. Ross, works manager. Mr. Ross outlined the growth of the Buffalo Works from two small buildings in 1889 to its present physical size and employment level of 2000. The tour took the members through the scrap yard, pattern shop, air, gas, and ammonia compressor assembly lines, the core room and the foundry.

The foundry was most impressive because of the gross size of the castings produced—most of them weigh in the thousands of pounds. A sand slinger capable of ramming 4000 lb. per min. shoots the sand out at such a velocity that only on very careful examination could the sand particles be seen.

The sand conditioners, hydro-wash, stress-relieving ovens, welding shop and motor assemblies departments were all visited. In the engine test room, actual setting-up tests were witnessed.

The tour continued through the various machine shops, boring mills, grinding sections, toolroom and finally the flask shake-out. Some of the flasks themselves weigh as much as 75 tons. After this, the sand is taken back to the reconditioning area where the process is started over again, but where the Chapter members decided to call it a night.

Boron Steels Useful For Small Parts On Large Scale

Reported by F. R. Anderson
Chief Metallurgist, Gardner-Denver Co.

Rocky Mountain Chapter learned much about boron-treated steels at its October meeting from Fred Robbins, A.S.M. trustee and president of the Sierra Drawn Steel Corp.

Mr. Robbins has found efficient use for such steels in production of small forged, machined and heat treated parts on a large scale. Boron is used in amounts as low as 0.001 to 0.003%!

Enhancement of hardenability is one advantage conferred by boron. Jominy testing has made possible a "cutting the cloth to fit the man" approach rather than overgrading alloys by the metallurgist to "take up the slack". A slightly concave end on the bottom face of Jominy bars to avoid up-creep of quenchant was advocated in the interest of greater accuracy.

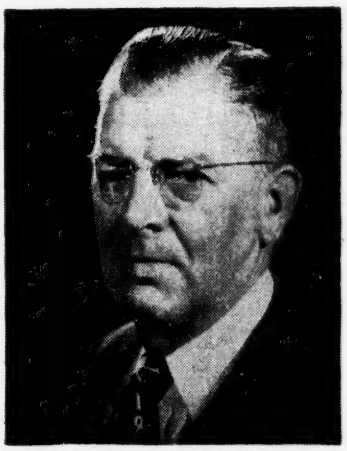
A 20% increase in forgeability is realized by boron steels as compared to alloy steels, probably as a result of the less refractory character of the scale when alloys are reduced. Die life is also similarly increased.

Improved machinability is another advantage. Mr. Robbins accorded uniformity of structure, piece to piece, a place of first importance in obtaining optimum machinability. Hardness of 0.45% carbon steels for best broaching or milling should be Rockwell C-18 to 22; for drilling, C-12 to 15. Best structure should consist of 75% lamellar pearlite and 25% spheroidal carbides, a structure best obtained by normalizing and tempering. With these conditions, A-4140 steel can be machined at 90 s.f.m., and boron-treated C-1045 at 109 s.f.m.—a 21% improvement.

Boron-treated 1045 displays ample hardenability for light tools properly hardened. They exhibit temper brittleness when drawn at 600° F. but this can be eliminated by water quenching from the tempering temperature. Lower ductility at lower hardness may account for better machinability. At higher hardness, properties of boron steels agree closely with other alloys.

Questions, graciously and clearly answered, threw light on individual problems—an accurate index of an interesting, well-presented subject.

Promoted by Kaiser



E. R. Babylon, Sales Metallurgist for Kaiser Steel Corp., and Past Chairman of the Los Angeles Chapter A.S.M., Has Been Transferred From That City to the Company's Headquarters in Oakland to Promote the Sale of Kaisaloy, a New High-Strength Low-Alloy Steel

Auto Assembly Plant In New England Visited

Reported by James Murray Hines
Sales Engineer, C. I. Hayes, Inc.

Rhode Island Chapter A.S.M. opened the new season with a 2½-hour tour through the modern assembly plant of General Motors Corp. at Framingham, Mass., on Oct. 5. Approximately 60 members were conducted along the miles of assembly lines from preliminary frame and body welding to final test and drive-away.

The guides emphasized the exceptional teamwork and closely controlled scheduling required to match assembly jigs, parts, accessories, and variation in color with a mixed production of all models of Oldsmobile, Buick and Pontiac on the line at one time. An assembly line of this sort is unique in the New England manufacturing area. This plant duplicates the general layout and operating procedures of similar assembly lines in the Midwest and gave the Providence men a brief education in the fabrication of a modern automobile.

In the evening, three General Motors representatives gave brief after-dinner talks. E. K. Cunliffe, personnel director, welcomed the members and introduced John Holmes, supervisor of labor relations, who spoke on the comparison of New England and Midwest labor problems. Mr. Oran, production manager, then answered a rapid-fire session of questions on tools, design, production problems, materials, inventory and comparisons with parent plants in Michigan.

Brittle Failures of Normally Ductile Steels Explained

Reported by S. A. Minton, Jr.
Allison Division, G. M. C.

"Selection of Steels for Adverse Conditions of Stress" was the large subject tackled by Maxwell Gensamer of Carnegie-Illinois Steel Corp. before the Indianapolis Chapter A.S.M. Oct. 10.

Because of the many "adverse conditions" under which steels operate, Dr. Gensamer confined his remarks to the brittle failures of steels normally considered ductile. These failures are characterized by their sharpness, smooth surface, and little evidence of plastic deformation previous to failure.

Perhaps the most famous example of this type of failure is the severing of welded merchant ships (few in number and not confined to the U. S., incidentally). Cracks are initiated at the point of highest stress at a defect and fail with a loud "crack". Progression of the crack proceeds at a velocity near that of sound. Investigation has shown that welding or flame cutting may provide defects that contribute to initiation of the crack. It then proceeds completely around the hull because of its monolithic construction. Cracks which appeared in earlier riveted structures were stopped at plate edges, resulting in minor, rather than major, destruction.

Such failures usually occur at the low-temperature end of the operating cycle. In the Liberty ships, failure often was initiated at or near square hatch corners where defects and design contributed to a high stress-concentration factor. One failure occurred at a 10,000-psi. load in a steel of 35,000 psi. yield strength.

Failures of this type are not confined to ships, but have also occurred in large tanks operating under relatively cool conditions. Although the failures are disastrous, percentage-wise, they have been few in welded structures.

Early investigations of brittle failures were concerned with duplicating service failures by tensile testing of 6-ft. wide ship plate. Subsequently, effects of stress raisers on various types of testing were determined and their effect on the "transition temperature" at which the change from ductile to brittle failure occurs. The transition temperature depends on the type of test and is raised by notch effects and stress raisers. Lowest transition temperature is obtained in torsion and highest in impact tests.

Suggested theories and explanations of brittle failure are based on analyses of uni-axial, bi-axial, and tri-axial loading, and their effects on testing and transition temperatures. Preliminary work indicates that the transition temperature of steels can be reduced by finer grain size and by nickel additions. Other elements may also reduce this temperature, either inherently (as with nickel), or through grain size effects.

To reduce the severity of welded ship hull failure, newer designs call for occasional riveted seams parallel to directions of highest stress to stop possible brittle crack progression.

Modern Brass Mill Offers Better Alloys

Reported by J. J. Buczynski
Taylor Instrument Companies

"Recent Developments in the Copper and Brass Industry" formed the theme of M. A. Buell's address to the Rochester Chapter A.S.M., on Oct. 10. Mr. Buell is chief sales metallurgist with the Bridgeport Brass Co.

Although over 3000 wrought alloys have been developed with copper as the major alloying agent, the fact remains that a large percentage of the total tonnage is by four classes—the free-machining brass, the 70-30, 65-35, and 85-15 Cu-Zn alloys. The desirability of the brasses for engineering applications stems from the ease with which they can be either hot or cold worked, their machinability, corrosion resistance, high conductivity, and pleasing color.

A variety of alloying additions can be made to the base copper-zinc alloys so as to obtain new or improved characteristics. Lead—perhaps the most common—is used to improve machinability and ease in blanking. Tin, nickel, iron and silicon are added to improve strength and corrosion resistance. Aluminum will promote wear properties and small additions of arsenic (0.02 to 0.05%) yield a significant increase in the resistance to corrosion without affecting any other property.

Alloying agents have broadened the use of copper as well as the brasses. Cadmium increases strength without noticeably decreasing the electrical conductivity of copper wire. Manganese has a beneficial effect on the welding properties. Beryllium with copper produces a series of heat treatable alloys that are characterized by high tensile and yield strengths.

Advances in processing techniques include progress in hot extrusion, bright annealing, and cold heading. Lead alloying techniques have been developed which will produce desired combinations of machinability and cold workability. Increased application of duplex sheet and tubing has been a result of wartime experience.

Better cooperation between the mill and the user has resulted in the establishment of correct and reasonable specifications where unusual conditions have been encountered. Accumulation of working data on brass alloys is working to eliminate risk in the absence of long experience. All in all, the modern brass and copper mill is able to provide better analyses together with closer temper and grain size control—factors that translate into improved performance and higher economy.

What Others Say...

About the 31st National Metal Congress and Exposition, Held In Cleveland Last October—

"It would seem that it is just not possible for any future show to be any better."—*Professor of Metallurgy, Case Institute of Technology.*

"We had six of our men present and they were all enthusiastic about the show."—*Director of Research.*

"We consider the show a real success."—*President.*

"Greeting the visitors was the greatest Metal Show of all times..... Cleveland was headquarters for the metals industry and many of the nation's top production experts."—*Iron Age.*

"In the lap of the American metallurgist rests the steel industry's very existence."—*A.S.M. banquet address, Charles R. Cox, President, Carnegie-Illinois Steel Corp.*

"The best Metals Show in which it has been our pleasure to participate as an exhibitor."—*Sales Promotion Manager.*

"The Show this year was the finest I have ever attended, and will, I am sure, produce results for some time to come."—*Director of Sales.*

"It can be said with not the slightest bit of exaggeration that we came away from the Show with the feeling that it would have been costly if we had not attended."—*Sales Manager.*

"We were quite elated with the whole show . . ."—*General Manager.*

"The Congress itself was superb."—*Head of Materials Laboratory.*

"The 1949 Cleveland Show surpassed the success of the 1948 show in Philadelphia, which was considered to be tops."—*Manager, Headquarters Sales.*

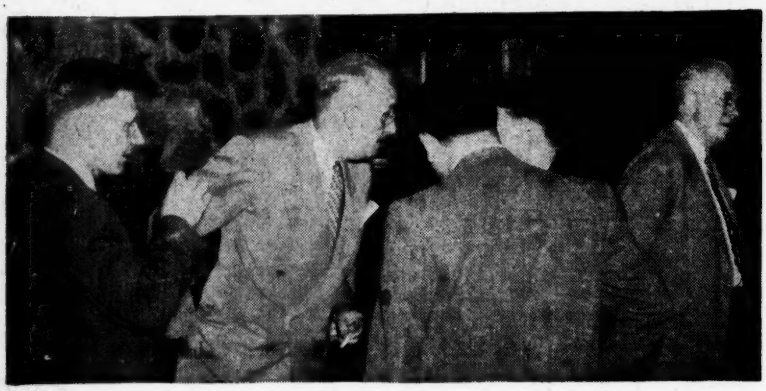
B.C. Makes Auspicious Start

Reported by P. Bland
Canadian Sumner Iron Works, Ltd.

An auspicious start was made by the British Columbia Chapter A.S.M. on its 1949-50 series of meetings the evening of Oct. 3. Main speaker of the evening was Fred J. Robbins, president of Sierra Drawn Steel Co. and an A.S.M. national trustee, while Sherwin Kelly of New York gave an illustrated travelogue as a coffee talk.

The lecture given by Mr. Robbins on boron steel is reported in detail on the opposite page.

Two Tests for Machinability Described



An Informal Group Talks Over Machinability at the October Meeting of the Eastern New York Chapter. At left is E. Nippes of Rensselaer Polytechnic Institute, a past chapter chairman, and next to him is George P. Witteman of Bethlehem Steel Co., the speaker. At extreme right is Bill Hodges of General Electric Co., another past chairman

Reported by Alexander Lesnewich
Rensselaer Polytechnic Institute

"Some Metallurgical Aspects of Machinability" were presented by George P. Witteman, assistant metallurgical engineer of Bethlehem Steel Co., at the Oct. 11th meeting of the Eastern New York Chapter A.S.M.

In production, it is desired to remove a maximum volume of metal with a minimum amount of rejections for finish or tolerance. A test for machinability combining all variables has yet to be developed, Mr. Witteman stated, and these variables are innumerable. They begin with the refining and alloying of the molten metal and end with the ability of the material to be machined. Included in these variables are the chemical composition of the steel, hot and cold forming operations, heat treatments, metal structures, machine tools, cutting speeds, cutting tools and fluids, and the operator.

Although it is possible to form a preliminary evaluation of the machinability of a steel by comparing its Brinell hardness and yield-tensile ratio, in the final analysis it is necessary to test the steel for its ability to be machined rapidly. Two tests of machinability were given.

The first, a long-range test, measures the number of pieces produced per hour in a machine operating at an efficiency of 75 to 80%. Cutting speeds and feeds are used as variables to produce required finishes and tolerances. The second is a short-time test in which rough-machined logs of a given diameter are turned at varying speeds per pass, holding the feed, tool design and depth of cut constant. The final tool contour, failures and finish are used for comparing the machinability of the steel with one which has been designated a standard.

Clears Misconceptions About Deep Drawing Sheet

Reported by Wilhelm Olson
Atwood Vacuum Machine Co.

Because a great deal of metal stamping is being done in this area, a number of plants sent delegations of press foremen and engineers to hear R. S. Burns speak about deep drawing of steel sheets before the Rockford Chapter on Oct. 26.

His position as associate director of Armco Steel Corp. research laboratory permitted him to speak with authority and correct some previous misconceptions. For instance he demonstrated that annealing cannot always remedy deep drawing problems; it may sometimes aggravate them.

Mr. Burns also made it clear that hardness alone is not the criterion of good drawing steel—the manner in which the hardness is achieved is the important thing. He amplified this point by demonstrating with slides the various factors that are involved in making good deep drawing steel. Method of manufacture, such as rimming and killing, ingot cropping, amount of final reduction, roller leveling and surface finish, were some of the primary considerations.

Panel Discussion on Ferrous Metallurgy Covers Wide Range

"Friendship Night" for the St. Louis Chapter A.S.M. on Oct. 21 Featured a Panel Discussion Which Promises to Be an Annual Event. Ferrous metallurgy was the subject of the discussion, which ranged over the topics of metallography, physical properties, heat treatment, quality control and plating advances. The panel, from left to right above, included George Fisher, metallurgical engineer of International Nickel Co.; D. S. Eppelsheimer, professor of physical metallurgy, Missouri School of Mines and Metallurgy (moderator); Robert Jacobi, chief metallurgist, Key Co.; E. F. Lundeen, factory representative, Inland Steel Co.; A. Czechowicz, foundry superintendent, Key Co.; and Lee De Wald, engineer, National Cylinder Gas Co. (Reported by H. O. Nordquist, manager, alloy and stainless steel dept., Joseph T. Ryerson & Son)

Spring Manufacture Closely Controlled

Reported by D. B. Graves
Federated Metals Division
American Smelting and Refining Co.

The dependency of the average American on springs in his daily life was described by E. T. Bittner, research metallurgist, American Steel Foundries, to the Calumet Chapter A.S.M. on Oct. 11 in opening his talk on "Railroad and Industrial Heavy Duty Springs".

The manufacture of springs has its ups and downs, with many factors affecting the quality of the finished product, he said. Close control of the manufacturing procedure is carried out at all times. Hardenability tests play an important part in controlling the service properties of the springs—much more so than chemical analysis.

After the spring has gone through the manufacturing process, the metal retains only about 40% of the original fatigue limit of the steel, the speaker pointed out. The designers of springs must take this into account when calculating stresses for carrying capacity.

Fatigue failures principally result from seams in the hot rolled rod, surface pits and defects, and overloading. Surface condition of the springs plays a vital role in the life of the product. Loss of the preset height during service also is detrimental to the life of a spring.

Because of the severe service conditions imposed on springs, a high quality steel is necessary, as well as careful manufacture and constant inspection to produce a high quality product.

Ductile Cast Iron Said Not Competitive To Gray Iron

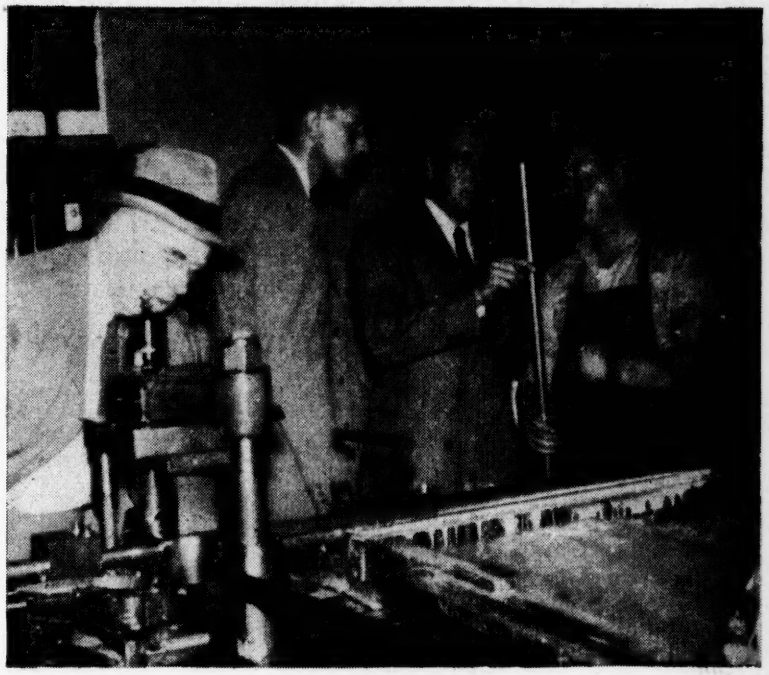
Reported by Howard E. Boyer
Chief Metallurgist
American Bosch Corp.

Following the custom established several years ago, the Springfield (Mass.) Chapter held its October technical meeting at Springfield, Vt. Ductile cast iron was the subject of the technical talk, presented by J. E. Fifield of the International Nickel Co.

Unless the higher engineering properties of this material are fully utilized, Mr. Fifield stated, ductile cast iron will not compete directly with gray iron for at least three reasons. First, some of the desirable properties possessed by gray iron, such as the ability to absorb vibration, are lacking in this new engineering material. Second, a higher degree of control is necessary to produce ductile cast iron, and third, the cost of ductile iron may be greater.

This newer type of iron may replace cast steel or malleable iron initially in some applications, the speaker predicted, but primarily it is intended to fulfill new and increased engineering demands.

Furniture Tubing Manufacture Observed



Worcester Chapter Members Inspect the Final Operation in the Integrated Seamless Steel Tube Mill at Heywood-Wakefield Co. Third from left, examining a finished piece of tubing, is Lincoln G. Shaw of Pratt & Inman, chapter secretary-treasurer. (Photo by C. Weston Russell)

Reported by J. Robert Douslin
Superintendent
Wyman-Gordon Products Corp.

A tour of the Heywood-Wakefield Co., furniture manufacturing plant in Gardner, Mass., featured the Oct. 12th meeting of the Worcester Chapter A.S.M. Following a brief question-and-answer period conducted by George Heywood, Jr., assistant general superintendent, the group adjourned for dinner and an address by Carl B. Lugbauer, advertising manager, on "Wood and Steel in the Furniture Industry".

Among the uses of metal, Mr. Lugbauer mentioned seamless steel tubing for spring-base chairs and transportation seating, steel wire springs for upholstered furniture, and steel frames for doll and baby carriages.

Of unusual interest was the integrated seamless steel tube mill, designed especially for the job. Flat strip is formed to tubular shape as it passes through a series of shaping rolls, is resistance welded, the weld upset milled off, and the tube then cut to length on a flying shear, all without interruption of stock flow through the mill. Also noteworthy was the manufacture of hourglass coiled upholstery springs to high quality standards.

A nontechnical, but none the less interesting part of Mr. Lugbauer's talk concerned furniture merchandising methods and company history.

Following the talk a question-and-answer period was held in which G. Reitan, purchasing agent, W. J. Carr, staff designer, and F. Nilsen, power plant engineer, assisted.

Color Slides Illustrate Various Copper Alloys

Reported by George W. Brown
Engineering Laboratory, I.B.M. Corp.

Southern Tier Chapter began its 23rd fall season with an enthusiastically received presentation of "Copper Alloys and Their Utilization" by Henry C. Ashley, metallurgical engineer for Chase Brass and Copper Co. The talk was illustrated with natural color slides.

Mr. Ashley discussed five classes of the hundreds of copper alloys, bringing out many important characteristics of the alloys that are often overlooked, such as reduction of electrical conductivity with cold working. His composite slides strikingly revealed the type of chips and microstructure of brasses ranging from good to poor in machinability.

Metallurgical Nature Difficult to Control In Large Forgings

Reported by F. R. Morral

Associate Professor, Syracuse University

Successful production of large forgings depends upon a series of metallurgical factors, some of which may get beyond the close control of the metallurgist when the mass becomes very great. Such metallurgical problems were discussed by A.S.M. Past President Francis B. Foley of the Midvale Co., before the Syracuse Chapter on Oct. 4.

All the undesirable effects which result inevitably from slow cooling of large molds will be present in the largest ingots, he said. A 272-ton ingot poured at the rate of 1½ tons of steel per min. into a 108-in. mold, weighing 212 tons, was used as an example. Slides illustrated the various steps.

Cooling rates are controlled by proportioning the area of mold to that of the molten metal. This "chill ratio" rarely exceeds 1.0. The size of the ingots is sometimes dictated by mechanical considerations of properties. Abilities and facilities to handle these ingots often outweigh metallurgical considerations. On a 200-ton mass of metal, the metallurgist has little control of cooling rate, although he does all he can to make it sound.

The 272-ton ingot produces a forging of about 136 tons. The difference is in the metal removed by cutting a sinkhead and bottom pool, and a 20% loss of weight from the scale formed in the many heatings necessary for forging.

Heat treatments suitable for large forgings are normalizing and annealing and tempering. Large forgings are used in turbine rotors and shafts, gun forgings, projectiles and heavy armor. "Flakes" and cracks and some of the techniques used to prevent them were discussed.

In a coffee talk, Kurt Sitte of the physics department of Syracuse University presented "cosmic rays" at the level of the laymen.

Films Show Industrial Uses of Foundry Chaplets

Reported by Donald A. Thompson

University of Manitoba

Two films on the use of various types of foundry chaplets and foundry chills, together with explanatory lecture, attracted one of the largest turnouts to date for the November meeting of the Manitoba Chapter A.S.M. J. S. Callaghan, president and general manager of The Canadian Fanner, Limited, gave a short history of his company and showed the many and varied uses of the products they manufacture.

The films showed molding operations in gray iron and steel foundries for the automotive, railway, farm implement, stove, boiler and radiator manufacturing industries. The films were especially prepared by Canadian Fanner to acquaint the foundry industry with the various types and uses of chaplets.

Movie and Talk Depict Induction Hardening in High-Frequency Ranges

Reported by Knox A. Powell

Research Engineer
Minneapolis-Moline Co.

A brief, clear-cut, illustrated lecture on "Induction Heating of Metal Parts" featured the October dinner meeting of the Northwest Chapter A.S.M. W. E. Berkey, electronics supervisor of the Northwestern District Engineering and Service Division, Westinghouse Electric Corp., gave the lecture, which was followed by a moving picture of industrial high-frequency induction and dielectric heating operations.

Mr. Berkey limited his talk to a succinct outline of the rules and application of audio and radio-frequency induction hardening of steel parts, omitting lower frequency mass heating as for forging. Projector charts illustrated the various factors and relationships that an induction heat treater has to use to determine power requirement, production rate, and depth of case for various metals.

Possibilities and limitations of high-frequency surface heating of steel were enumerated, and problems of importance to supervising metallurgists were indicated. Outstanding advantages of induction hardening are the absence of preparatory delay, speed, the rapid repetitive sequence suitable to uninterrupted straight-line production, ease of case control, and the ability to secure results from cheaper steels.

The moving picture showed induction and dielectric heating applications on a variety of work. Clever automatic handling and loading devices contribute to economy of labor. Simplified manufacture of wristpins was illustrated, in which only automatic audio-frequency heat treatment is used to toughen the body, and radio-frequency surface heating and quench for the case, as compared with stop-off plating, grinding the outside, furnace carburizing, and furnace heat and quench hardening in conventional manufacture. Induction treated wristpins, moreover, have added strength and cost advantages.

Slides were shown of recent installations of automatic work-handling machines for induction hardening transmission gears, splined shafts, mower blades and piston pins.

Compliments

To GEORGE V. LUERSSEN, chief metallurgist, Carpenter Steel Co., and CARL B. POST, of the metallurgical staff, on the award of a certificate of merit by the American Institute of Mining and Metallurgical Engineers, Pittsburgh Section. The award is in recognition of their paper describing a new method for melting better steel.

To LESLIE W. BALL, chief of the mechanical evaluation division of the Naval Ordnance Laboratory, on his election as president of the Society for Non-Destructive Testing.

To ALBERT S. GLOSSBRENNER, assistant vice-president of the Youngstown Sheet and Tube Co., on his election as president of the Association of Iron and Steel Engineers.

To O. B. J. FRASER, assistant manager, development and research division, International Nickel Co., on his election as president of the American Welding Society; to JOHN A. GRODRIAN, director, factory laboratory, Bendix Aviation Corp., and a past chairman of the Notre Dame Chapter A.S.M., on his election as a district vice-president for A.W.S.; to L. C. STILES, plant superintendent, Chicago Bridge and Iron Co., elected third district vice-president; and to A. F. DAVIS, vice-president and secretary, Lincoln Electric Co., on his election as a director.

To ROBERT E. CAFFREY, B.S. in Metallurgy, Pennsylvania State College, June 1949, on receipt of the first Behrmann Scholarship Award for graduate work in the School of Mineral Industries.

Basic Principles Behind Heat Treating Explained

Reported by Edwin V. Zahorik, Sr.

Maresh Sheet Metal Works

The basic principles of heat treatment, as discussed by R. D. Manning of Carnegie-Illinois Steel Corp. at the October meeting of the Cedar Rapids Chapter, answered the "why" behind the rules commonly accepted for heat treating techniques. Mr. Manning gave a clear exposition of the basic physics and chemistry involved in heat treatment, explaining the reasons for the heating and quenching operations at specific temperatures and for specified times.

Preceding Mr. Manning's address, the chapter was entertained by Tait Cummins, sportscaster for Radio Station WMT, who contrasted the certainties of metallurgy with the uncertainties of football.

Faulty Design Greater Culprit Than Poor Steel In Toolsteel Failures

Reported by A. C. Willis
Instructor, Southern Methodist University

Causes of toolsteel failure, according to J. Y. Riedel, toolsteel engineer with the Bethlehem Steel Co., can be classified into six groups. These are design, heat treatment, steel defects, grinding checks, heat checks and incorrect steel composition. Mr. Riedel addressed the North Texas Chapter A.S.M. on Oct. 5 on "Toolsteel Failures—Their Cause and Cure".

Faulty design is responsible for more failures than are commonly attributed to it, the speaker said. Steel defects, on the other hand, are responsible for a very small percentage of failures, despite the temptation to blame failures on poor steel.

Improper heat treating procedure —which accounts for about 80% of steel failures—can be further subdivided into the following malpractices: failure to harden, due to overheating, underheating, decarburization or too low a cooling rate; cracking, due to overheating, allowing a quenched tool to become "stone" cold, or failure to temper or stress-relieve immediately after quenching; too rapid tempering; and attempts to maintain a higher hardness than is necessary.

Grinding checks are always difficult to analyze. Too rapid removal of material, dull wheels, too fine a grit, and ineffective use of coolant will all produce grinding checks; however, an improperly heat treated piece cannot well be ground. Since they are so small, grinding checks normally are brought out by magnetic or fluorescent testing, or by cold acid etch.

Heat checks are to be expected eventually in a tool used in hot working operations, but will be accelerated by poor design or improper use.

Improper composition usually means that the tool has been made from a different steel than was specified.

Fatigue, or progressive failure, is a common type of failure. Usually it can be traced to poor design, sometimes to decarburization.

Mr. Riedel's talk was supplemented with numerous slides.

Boron Steel Uses Justified

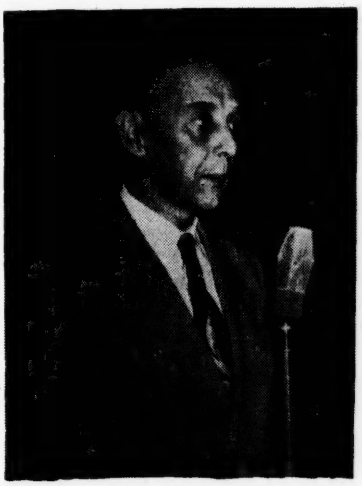
Reported by Sayre S. Williams
Mechanical Engineer
U. S. Navy Electronics Laboratory

At the September meeting of the San Diego Chapter A.S.M., Fred J. Robbins, president of Sierra Drawn Steel Co. and A.S.M. national trustee, outlined the reasons for the growing importance of boron steel as a material for certain products. Mr. Robbins's talk is outlined in detail on page 14.

Material and Fabrication Choice Involves Service Requirements of Product

Reported by Benjamin Gray
Gray Engineering Co.

In contemplating the materials and fabrication processes concerned in product design, the metallurgist must keep in mind the service requirements



J. A. Burgard

of the product, J. A. Burgard of Columbia Steel Co. told the first meeting of the Los Angeles Chapter A.S.M. Speaking on "Application of Metallurgical Principles in Product Design", Mr. Burgard sounded the keynote for the technical talks that are to follow during the season.

As an example, Mr. Burgard cited a product to be subjected to abrasion in use, and pointed out that a complete analysis of the type of abrasion is necessary to make an intelligent choice of metal or nonmetal.

Types of abrasion may be classified as impact type (such as might be caused by fall of heavy rock), dry grit sliding type (materials sliding down chutes), dry metal-to-metal type (gudgeon bearings), lubricated metal-to-metal type (automotive engines or gear units), lightweight, high-velocity, dry impact type (sandblasting), and cavitation (high-velocity light-particle impact in fluid carriers).

Materials to withstand these types of abrasion include Hadfield's manganese steel, abrasion resisting steels, white cast iron, deep-carburized steels, hard facing overlays, cast iron, and lead, as well as various nonmetallics.

Product design may also involve minimum weight requirements, and the metallurgist may select from the nonferrous alloys, aluminum, magnesium, and, in recent months, titanium.

When strength and hardness are a major factor, a wide variety of alloy steels is available. In addition, the metallurgist must frequently amend his choice to accommodate secondary influences of the alloys.

Machinability, heat treatment, forging characteristics, weldability, and sometimes distortion expectancy in final heat treatment must be considered. Performance conditions may involve high-temperature creep strength, low-temperature impact values, resistance to notch sensitivity, or the presence or absence of magnetic properties.

In fabrication by welding, Mr. Burgard said, all too often products are designed with a half-hearted faith, resulting in combinations of welding and riveting that are doomed to early failure. In such improper design, the welding may shear the rivets, or either the rivets or the weld may end by carrying no load.

In product design, as well as processing methods in the shop, a practical metallurgist may save many times his salary in the cost of time and materials, and in the insurance of a serviceable product in a competitive market. To do his best work, a good metallurgist should rank at least equal to the chief engineer, and should be consulted by him in the early stages of the design, the speaker concluded.

Controlled Atmospheres Solve Heat Treat Problems

Reported by G. A. Warwick
General Electric Co.

An informative presentation of up-to-date controlled-atmosphere heat treating techniques was presented by O. E. Cullen during the October meeting of the Fort Wayne Chapter A.S.M. Mr. Cullen is chief metallurgist of the Surface Combustion Corp.

The rigid control possibilities of generated gas mixtures for a wide variety of specialized thermal processes were illustrated by slides. The group showed particular interest in the methods used to predict reactions between atmospheres and hot steel.

Factors such as carbon potential and equilibrium ratios of active gases were proven essential to the development and application of gas carburizing, dry cyaniding, carbon restoration (skin recovery), and homogeneous carburization, a process whereby fabricated metal parts of thin section made from low-carbon steel can be heat treated in an atmosphere to transform the metal to a medium or high-carbon steel, as desired.

In conclusion, some actual examples were cited to explain the use of fundamental atmosphere relationships in the solution of difficult case hardening problems.

New Types of Alloys For High-Temperature Use Predicted for Future

Reported by Roger D. Moeller
Staff Member
Los Alamos Scientific Laboratory

The involved field of high-temperature alloys was ably covered by H. C. Cross of Battelle Memorial Institute at the first technical meeting of the year of the Los Alamos Chapter A.S.M. Mr. Cross emphasized the four considerations involved and the use of the creep test and stress-rupture test in evaluation.

Among the many variables in the development and production of high-temperature alloys, composition is minor compared to the variables found in processing.

Among the alloys discussed and evaluated by Mr. Cross were the wrought chromium-nickel-iron alloys, the heat treated chromium-nickel-cobalt-iron alloys, the solution treated and aged nickel-base alloys and the as-cast or as-cast and aged cobalt-base alloys. All of these alloys are in commercial production and many data have been compiled upon their processing variables and the properties that may be expected.

Mr. Cross emphasized the difficulties involved in obtaining reproducible results with any of these alloys. He is looking to the development of chromium-base alloys for use at somewhat higher temperature levels in the immediate future. There again, the greatest difficulty is reproducibility of results.

In the more distant future the use of intermetallic compounds such as molybdenum disilicide, and of ceramals such as titanium carbide in a cobalt matrix, holds great promise. Another field that has just been touched consists of alloys of the refractory metals—molybdenum, tungsten, titanium, and columbium. The greatest difficulty with metals in this category is their lack of oxidation resistance. It will probably be found necessary to coat the metals to produce a more oxidation resistant surface.

Mr. Cross concluded his talk with a discussion of the possible uses of titanium and titanium-base alloys in gas turbines.

Steel Sales Executive Dies

Val Hansel, New York sales manager of Peter A. Frasse and Co., Inc., steel distributors, died Oct. 25 of a heart attack. He was widely known to the metalworking trade of New York, Connecticut and New Jersey.

Mr. Hansel spent his entire business career in the steel industry, having at one time been connected with the Union Drawn Steel Co. in Hartford, Conn. (now a division of Republic Steel Corp.). He joined Frasse in 1925 and was appointed sales manager of its New York district in 1939. He was particularly noted for his efforts during World War II in establishing stocks of aircraft steels for eastern aircraft industries.

He was a member of the Executive Committee of the New Jersey Chapter A.S.M.

Sachs Opens Consulting Offices With Croft, Others

George Sachs has resigned from his position as director of the Indian National Metallurgical Laboratory, and is now president of Metals Research Associates of Cleveland, consultants in research, development, and plant improvement in the fields of casting, metal fabricating and heat treating.

In this new venture he will be associated with Harry P. Croft, A.S.M. national trustee; C. F. Prutton, formerly on the faculty of Case Institute of Technology; George B. Espey, metallurgist, and Lee Wilson, president, Lee Wilson Engineering Co.

Dr. Sachs will also act as a consultant to the National Advisory Committee for Aeronautics. He is the recipient of a War and Navy Departments' certificate for outstanding contribution to the work of the OSRD during World War II. Dr. Sachs had directed NDRC and OPRD projects for the aircraft industries at Case Institute of Technology, where he was formerly head of the department of metallurgy.

Offers Metallurgy Degree

A degree in metallurgical engineering is now being offered by Syracuse University in its department of materials engineering. Although the student is given a broad background in the entire field of metallurgy, adaptive metallurgy is emphasized in the curriculum, as opposed to extractive metallurgy. Students will thus be prepared for careers in the metals processing industries such as hot and cold forming, foundry practices, metal joining, surface and heat treatment, and powder metallurgy. B. J. Lazan is head of the department of materials engineering, and F. R. Morral is associate professor.

Lienhardt Goes to New York

W. S. Lienhardt, vice-chairman of the Calumet Chapter A.S.M., has been transferred from general superintendent of the East Chicago plant of the Metal and Thermit Corp. to technical assistant to the vice-president in New York City. H. B. Wishart, metallurgist for Carnegie-Illinois Steel Corp., will act as vice-chairman for the rest of the year.

Scientific Foundry Method Brings Improvements In Quality of Castings

Reported by Sam F. Carter
American Cast Iron Pipe Co.

General improvement in the quality of metal castings has come about because of more scientific methods in the foundry, better metallurgical control, and modern testing and inspection methods, C. K. Donoho, chief metallurgist of the American Cast Iron Pipe Co., claimed before the November meeting of the Birmingham Chapter A.S.M.

Freedom from gas unsoundness can now be assured by a properly controlled final deoxidation. Recent research on solidification rates and heat transfer has provided more exact control of internal shrinkage. The size and location of risers can now be determined on a scientific basis by a formula relating the surface area-to-volume ratio of the riser to the casting.

Nondestructive inspection methods such as X-ray and Magnaflux have made it possible to guarantee the soundness of castings. Developments in heat treatment improving the properties of the metal were illustrated by typical microstructures and physical property figures.

In a cast part the choice of alloy content is not limited by any effect on workability, and Mr. Donoho reported some unusually high combinations of physical properties for some cast alloy compositions. A number of static and centrifugal castings of carbon and high-alloy steels were pictured. The good service records of these materials in the past war have done much to verify the serviceability of castings.

The speaker reviewed the properties of cast iron that make it a choice for certain applications involving wear resistance, damping capacity, soil corrosion resistance, and heat resistance. The unusual properties of the new "nodular graphite iron" or "ductile irons" were illustrated. The strength-hardness relationship, impact strength, and several other properties lie somewhere between gray iron and steel, and are similar to those of annealed malleable.

In many gray iron castings the flake graphite form is necessary for the properties desired and nodular iron would not be a wise substitute. In other instances, serviceability of gray iron castings would be improved considerably by the greater ductility. Mr. Donoho expressed his belief that this new iron will not replace any of the present metals but will give the engineer another foundry material from which to choose, and give the foundries another material to offer without the need of specialized equipment.

Practical Pointers Aid Heat Treater in Threefold Problem

Reported by T. Carlson

United States Steel Supply Co.

Practical "Discussions on Heat Treating" were presented to the Puget Sound Chapter A.S.M. on Oct. 19 by J. C. Youlten, co-owner of the Commercial Steel Treating Co. in Seattle.

In order to hold the shape and surface of the article to be heat treated, the lowest possible temperature should be employed, the speaker advised. The designer of a tool or die is in a great measure responsible for the results of heat treatment, and the cracking of parts is often the result of design. Where inadequate fillets and light and heavy sections are joined, cracks will develop during heat treatment. Complicated tools and dies should not be made from water hardening steels.

Steel coming from the mill is almost always decarburized, and $\frac{1}{16}$ in. should be removed from each part to insure surface hardness in later treatment. Because of the difference in the coefficient of expansion between the carburized and decarburized portions of the steel and the parent metal, such steels will have a tendency to crack during heat treatment.

The two forces tending to break steel parts are the internal forces incurred in fabrication and the external service stresses. Careless technique in heat treating can and does cause high internal stresses.

Dimension tolerances can be controlled by avoiding overheating, which will cause expansion, and underheating, which causes shrinkage. A cold tool or die should not be placed in a hot furnace. Heating too rapidly can also cause cracking of a finished or semifinished part.

During quenching, agitation is important to alleviate gas pockets which are formed during the first and second phase of gas and vapor formation. The article to be quenched should be introduced into the quench at an angle so as to allow gas bubbles to escape and thereby eliminate the danger of soft spots forming on the quenched piece.

The problems of the heat treater are threefold, Mr. Youlten concluded. He is expected to do the work fast, inexpensively and, above all, correctly.

Transferred to LaSalle Steel

Charles A. Davis, charter member and past chairman of the Peoria Chapter A.S.M., and formerly with Caterpillar Tractor Co. as developmental engineer, is now manager of product development at La Salle Steel Co., Chicago.

Boegehold Presents Woodside Lecture

Reported by H. H. Benninger

Peninsular Steel Co.

Tribute was paid to William Park Woodside at the Oct. 10th meeting of the Detroit Chapter A.S.M. As a founder member and past president, Bill Woodside has become the chapter's most famous native son, and has been accorded the distinction of an annual dinner meeting given in his honor.

Discussing comparisons between test bar data and tests on components of mechanical structures, A. L. Boegehold upheld the high standards established in six previous Woodside lectures. Mr. Boegehold, likewise a past national president, is head of the metallurgy division of General Motors Research Laboratories.

His carefully collected and catalogued data supported his conclusion that test bars do not normally give a fair measure of the results that may be expected from service parts. This wide discrepancy between test bars and components may be attributed to such items as differential cooling between the surface and center of different sized parts being heat treated, to difference in stress patterns as influenced by hardenability patterns, and similar phenomena.

A. L. Boegehold (Left) Presented the Annual Lecture Honoring Billy Woodside (Right) at the October Meeting of the Detroit Chapter

Atomic Power Plant Operation Described

Reported by L. H. Decker

Revere Copper and Brass, Inc.

A talk on the subject of "Atomic Energy", presented before the Rome Chapter A.S.M. on Oct. 10, dealt largely with the development of atomic power for peacetime use. The speaker was Bruce R. Prentice, member of the nucleonics department of General Electric Co.

Researches in atomic energy offer two major benefits to humanity, the speaker explained, namely, a completely new major source of power, and the use of radio-isotopes to solve problems in medicine, biology, chemistry and metallurgy.

Using schematic diagrams, Mr. Prentice described the operation of a nuclear power plant. Maintenance, as well as operation, of such a plant must be handled by remote control. This presents problems in materials engineering which have never had to be faced before in plant operation, and accounts for the long periods of time required to construct an atomic power plant. It is expected that an experimental nuclear power plant will be completed near Schenectady in about three years.

Gustave Pirk, chief metallurgist at Rome Cable Corp., presented a coffee talk on some of his experiences in "Applications of Metallurgy to Criminal Investigation".

Telephone Progress Traced Within Single Lifetime

Reported by Kenneth Uran

Speaking on the subject of "Communication", Emmett C. Belzer of the Indiana Bell Telephone Co. described the progress of the telephone industry within a single lifetime before the September meeting of the Terre Haute Chapter A.S.M. The many steps in this progression from a crude device to the present highly perfected units were illustrated by models.

He told how the voice can be transmitted by various means, and traced the history of distance communication from early tom-tom and smoke signal methods through Alexander Bell's devices up to our modern telephone. Some avenues for probable future progress were pointed out.

Coaxial and radio relays are playing a large part in carrying television programs, as well as in hundreds of telephone conversations. Quartz crystals are used for separation of conversations carried by the coaxial cable, and Mr. Belzer explained the methods used for growing such crystals in the laboratory.

Betatron Expert Speaks

Reported by Robert L. Needham

Metallurgical Engineer
Delco Products Div.

At the second meeting of the Dayton Chapter A.S.M., held on Oct. 12, Jack T. Wilson spoke on "Metallurgical Aspects of Super-Voltage X-Ray". Dr. Wilson is chief physicist for the Allis-Chalmers Mfg. Co., and is closely associated with the production of betatrons operating at 22 million volts. His talk has been reported in previous issues.

CHAPTER MEETING CALENDAR

CHAPTER	DATE	PLACE	SPEAKER	SUBJECT
Akron	Jan. 11	University Club	C. F. Prutton	Corrosion of Metals
Baltimore	Jan. 16	Engineers Club	John M. Hodge	Hardenability of Steels
Boston	Jan. 6	Hotel Sheraton	J. H. Hollomon	Physics of Metals
Calumet	Jan. 10	Phil Smidt's	J. S. Smart	Continuous Casting of Copper
Canton-Massillon	Jan. 10	Mergus Restaurant		President's Night
Cedar Rapids	Jan. 10	Roosevelt Hotel		
Chicago	Jan. 23	Furniture Mart Bldg.	A. E. Focke	Mechanical Testing of Metals from Physical Metallurgist's Viewpoint
Cincinnati	Jan. 12	Engineering Society	E. E. Thum	Implications of Atomic Energy
Cleveland	Jan. 9	Tudor Arms	A. E. Focke	Mechanical Testing
Columbus	Jan. 30	Fort Hayes Hotel	Panel Discussion	Solving Metallurgical Problems in Industry
Dayton	Jan. 11	Engineers Club	Howard Cross	Titanium and Titanium Alloys
Detroit	Jan. 9	Rackham Bldg.	F. L. LaQue	Corrosion
Fort Wayne	Jan. 9	Chamber of Commerce	J. F. Cerness	Bearings
Hartford	Jan. 10		S. C. Lawson	Copper Alloys
Indianapolis	Jan. 16	McClarney's Restaurant	Cyril Wells	Transverse Properties of Steel
Los Alamos	Jan. 23	Civic Club		Metallurgical Round Table
Los Angeles	Jan. 12	Institute of Aeronautical Sciences Bldg.	Richard Pomeroy	Corrosion and Protection of Products
Louisville	Jan. 10		E. E. Thum	Recent Developments in Stainless Steels
Mahoning Valley	Jan. 10	V.F.W. Hall	R. F. Miller	Properties of Steel at Elevated Temperatures
Milwaukee	Jan. 24	City Club	A. E. Focke	Mechanical Testing and Wear Testing
Montreal	Jan. 4	Queens Hotel		Movies
Muncie	Jan. 10	Central High School	E. I. Larsen	Powder Metallurgy
New Haven	Jan. 19	Conn. Light & Power Co. Aud., Waterbury	J. R. Long	Titanium and Its Alloys
New Jersey	Jan. 16	Essex House, Newark	B. W. Gonser	Titanium
New York	Jan. 9	Building Trades Club	Joseph Zimmerman	The Metal Situation
North West	Jan. 19	Covered Wagon	E. Pavesic	Heat Treating Hints
Notre Dame	Jan. 25	Engineering Auditorium, Univ. of Notre Dame	A. E. Focke	Wear and Wear Testing
Ontario	Jan. 6	Royal York Hotel, Toronto	Carl Zapffe	New Concepts of Solid State
Ottawa Valley	Jan. 3	Bureau of Mines	H. G. Warrington	Some Effects of High Purity Metal on Magnesium Alloys
Peoria	Jan. 9		Michael Field	Metal Cutting Research
Philadelphia	Jan. 27	Engineers Club	N. K. Koebel	Heat Treating in Controlled Atmospheres
Pittsburgh	Jan. 12	Roosevelt Hotel	A. E. Focke	Metallurgy and Manufacture of Chains
Purdue	Jan. 17	Purdue Memorial Union	S. P. Snyder	Some Practical Aspects of Engineering with Copper and Its Alloys
Rochester	Jan. 9	Howard Johnson's	A. F. Holden	Salt Baths
Rockford	Jan. 25	Faust Hotel	A. M. Setapen	Silver Brazing
Rocky Mountain				
Pueblo	Jan. 19			Toolsteels
Denver	Jan. 20			
Saginaw Valley	Jan. 17		D. E. Krause	Nodular Graphite in Cast Iron
Southern Tier	Jan. 9	Mark Twain Hotel, Elmira, N. Y.	Paul G. Nelson	Deep Drawing Sheet Steel
Springfield	Jan. 16	Hotel Sheraton	E. F. Nippes	Weldability of Steels
St. Louis	Jan. 20	Forest Park Hotel	F. G. Tatnall	Relationship between Engineers, Metallurgy, and Material Specifications
Syracuse	Jan. 3		O. J. Horger	Relationship of Metallurgy and Design
Terre Haute	Jan. 9			Acoustics—Vibrations and Noise
Texas	Jan. 3			
Toledo	Jan. 26	Maumee River Yacht Club	B. F. Bregi	Metallurgy of Gears
Tri-City	Jan. 10	Rock Island Arsenal Cafeteria	O. E. Cullen	General Heat Treating—the Practical Side
Tulsa	Jan. 9	Michaelis	R. S. Sheehan	Meehanite
Utah	Jan. 26	Newhouse Hotel, Salt Lake City	Wm. G. Theisinger	Clad Steels
Warren	Jan. 19	El Rio	John A. Randall	Welding Applications in Automotive Construction
Washington	Jan. 9	Garden House, Dodge Hotel	John C. McDonald	Recent Developments in Magnesium
West Michigan	Jan. 16		Walter Breeler	Toolsteel and Its Application to Industry
Western Ontario	Jan. 20	Norton Palmer Hotel, Windsor	I. Reid	Selection of Furnaces for Particular Jobs
Worcester	Jan. 10	Putnam & Thurstons		Carbide Symposium
York	Jan. 11			

Truck Bodies and Wheels Furnish New Applications For Magnesium Alloys

Reported by G. W. Birdsall
Reynolds Metals Co.

Information on some of the more interesting new applications for magnesium alloy castings was presented before the first meeting of the fall season of the Louisville Chapter A.S.M. on Oct 4. Ralph L. Huft, product research engineer with Hills-McCanna Co., Chicago, was the speaker of the evening.

He first presented two movies, one on the applications and advantages of magnesium, the other on its production from sea water, how it is made into castings and the machining of the castings.

Because magnesium machines so readily at exceptionally high speeds and feeds and yet produces a good surface finish, the higher metal cost of a magnesium part may often be more than offset by the savings where considerable machining is involved, the speaker pointed out. In fact, magnesium parts have even competed successfully pricewise in certain cases with gray iron parts because of the dollars saved by the saving in machining time.

As early as 1943, entire truck bodies of magnesium were built, permitting greatly increased payloads. For instance, a part that weighs 28 lb. when made of steel will weigh 10 lb. if made from aluminum, but only 6.3 lb. if made from magnesium. That means the payload can be increased by 21 lb. for this one part.

An actual instance of typical savings in truck under-components is the wheel hub casting of magnesium which weighs only 18 lb. and supersedes a 47-lb. malleable iron casting which had thinner walls. Magnesium brake spiders weigh 5½ lb. compared to 11 lb. in malleable and the 24-lb. brake shoe was successfully reduced to 9 lb. Even with the increased wall thickness, the magnesium unit saves 129 lb. per axle. Since this is unsprung weight, this reduction greatly improves the performance of the truck.

Another important recent development described by Mr. Huft is the adoption of magnesium wheels, safety hubs and engine parts for racing cars. At a present cost of $16, they are competitive with steel wheels and give higher strength qualities.

Among other numerous new applications are plasterers' hods, electrical and air tools, safety tongs, foundry flasks, engravers' mounting blocks, printers' chases, industrial hand trucks, cameras and projectors, baseball masks and aircraft and auto engine parts.

Mr. Huft also mentioned that magnesium is not desirable for applications where direct wear or abrasion resistance is involved, unless proper consideration is given to the use of inserts. Magnesium alloy, industry's lightest structural alloy, can offer the designer excellent physical qualities, inexhaustible source of supply at prices competitive or lower than other nonferrous materials.

Secretary Changes Address

Ernest G. Guenther, secretary-treasurer of the Milwaukee Chapter A.S.M., has requested that other chapter secretaries be notified of his new address so that they may revise their mailing lists for chapter meeting notices. His address has been changed from 1425 North Jackson St. to 526 East Ogden Ave., Milwaukee 2, Wis.

Low-Hydrogen Electrodes For Welding Discussed

Reported by Edwin V. Zahorik, Sr.
Maresh Sheet Metal Works

D. C. Smith, chief metallurgist, electrode division, Harnischfeger Corp., addressed a regular meeting of the Cedar Rapids Chapter A.S.M. on modern trends in welding techniques. Particular emphasis was placed on the low-hydrogen series of electrodes, their advantages and limitations. Dr. Smith also covered inert gas welding and contact welding.

In lieu of a coffee speaker, motion pictures of the Iowa-Northwestern football game were shown.

buying alloys?

only at Ryerson

do you get these three:

1 Stocks of selected quality

2 Test-proven performance

3 A guide to heat treatment

...yet Ryerson gives you this three-way guarantee of satisfaction at no additional cost. So contact the Ryerson plant nearest you for any alloy steel requirement.

OTHER RYERSON PRODUCTS

Bars—Stainless, hot rolled and cold finished carbon steel, reinforcing

Structurals—I Beams, H Beams, channels, angles, etc.

Plates—Sheared and U. M., Inland 4-Way Floor Plate

Sheets—Hot and cold rolled, many types and coatings

Tubing—Seamless and welded mechanical and boiler tubes

Stainless—Allegheny metal bars, sheets, plates, tubes, etc.

RYERSON STEEL

JOSEPH T. RYERSON & SON, INC. PLANTS: NEW YORK, BOSTON, PHILADELPHIA, DETROIT, CINCINNATI, CLEVELAND, PITTSBURGH, BUFFALO, CHICAGO, MILWAUKEE, ST. LOUIS, LOS ANGELES, SAN FRANCISCO.

Crystal Structure and Phase Transformations

(Continued from page 6)

sigma. The experiment, though not important by itself, indicates that carbides having an Fe:Cr ratio in nearly the correct proportion can be decarburized to form sigma. In practice, this might occur by external decarburization of parts subjected to high temperatures or by internal decarburization during heat treatment when stronger carbide-forming elements, such as titanium or molybdenum, are present.

A compound FeMo, stable only at high temperatures, has the structure (unknown) of the sigma phase (4C-72, Sept. 1949). Others having the sigma structure are FeV and Co_2Cr_8.

Several studies of the behavior of nitrogen and carbon have been made. Jack (4B-2, Feb. 1949) determined the crystal structures of the nitrides Fe_4N, Fe_3N, and Fe_2N, and also of the iron nercarbide Fe_3C first discovered by Hägg many years ago. Fe_3C is orthorhombic and is stable below 450° C. Carbonitrides with the Fe_2N structure and with as much as 75% of the nitrogen replaced by carbon were prepared by reacting Fe_2N with carbon monoxide. If more nitrogen was replaced by carbon, the structure changed to that of Fe_3C or Fe_3C. The Fe_3N structure dissolved at least 16 atomic % carbon. The author pointed out the relation of his results to the tempering of steel. Heidenreich and coworkers had reported a phase with the Fe_3N structure that formed on tempering martensite at 200° C. This could have been a carbonitride which would decompose on further tempering to Fe_3C or cementite. Hofer and Peebles (4B-13, March 1949) found a hexagonal close-packed Fe_3C structure stable up to 300° C., in addition to the orthorhombic structure found by Jack.

Internal friction measurements have indicated that the precipitation of nitrogen from solid solution in alpha iron occurs in two stages (4B-18, April 1949). In the first stage, plates of an unknown precipitate are formed on the (100) planes while, in the second stages, plates of Fe_4N are formed. In the precipitation of carbon, however, only one stage is observed.

In a study of carbide precipitation in the secondary hardening of alloy steels (18b-144, 1948), Crafts and Lamont detected Fe_3C in the extracted residues after tempering in the lower range of temperatures. For higher temperatures, Fe_3C and alloy carbides were found.

The so-called allotropic modification of chromium whi. has hexagonal structure in the electroplated condition has been identified by Snavely and Vaughan as a chromium hydride CrH (4A-14, March 1949). The recognition of this structure as a hydride is more reasonable than a previous assumption that the chromium atoms acquire unusually large radii in the electrodeposited form. Another electrodeposited hydride CrH_2 has a fluorite structure.

Nonferrous Metals and Alloys

Apparently only one new allotropic modification of a metal has been determined. It was found by Lawson and Tang (4C-74, Sept. 1949), who investigated the large decrease in volume which Bridgman had observed in cerium at 12,400 atmospheres. Since the cerium is cubic close-packed at ordinary temperatures, it was intriguing to learn what structure could be more close-packed. At 15,000 atmospheres, the transformation proceeded and the structure was found to be also cubic close-packed! The lattice constant had suddenly dropped from near the usual value of 5.14 Å to a new value of 4.84 Å. As a result of calculations on the atomic size, it was concluded that the size of the cerium atoms had been decreased by literally squeezing the single 4*f* electron into a state with a smaller atomic diameter.

Evidence has been found for a new modification of titanium stable between 860 and 900° C., but it is not based on direct structural studies (4C-73, Sept. 1949).

Further studies of manganese-base alloys have confirmed the tendency for the ductile gamma modification of manganese to form continuous series of solid solutions with face-centered cubic metals. It had been known that the face-centered tetragonal gamma phase approaches the face-centered cubic structure and actually becomes face-centered cubic when sufficient copper is in solution. Likewise, in the Mn-Zn and Mn-Ni system (4d-36, 1948), (4C-54, July 1949), gamma reaches the truly cubic state at 23% Zn and 25 to 30% Ni, respectively, while only 9% Co is sufficient to produce the change (4C-99, Oct. 1949). In the Mn-Ni system, the gamma phase exists in a continuous series of solid solutions under the solidus from 0 to 100% nickel. The ductile gamma manganese produced by electrodeposition transforms near room temperature to the brittle alpha form without passing through the beta modification (4C-67, Aug. 1949).

The crystal structure of Ni_4W is not face-centered tetragonal of the cell size previously reported, but must be described by a larger body-centered cell with lattice constants 5.730 and 3.553 Å (4C-42, May 1949).

It had been suggested that, if the aluminum in the ferromagnetic Heusler alloy Cu_2MnAl (Fe_3Al structure) were replaced by indium, the superlattice would be more stable. The alloy Cu_2MnIn was therefore prepared and found to be ferromagnetic in the as-cast state (4C-35, May 1949). The alloy Cu_2MnGa was only feebly magnetic and was not single phase. With more copper and less gallium, the alloys become strongly magnetic when quenched (4C-82, Oct. 1949).

In investigating the effect of foreign atoms on the process of ordering in gold-copper alloys, nickel was found to be statistically distributed in the AuCu and $AuCu_3$ superlattices, and to have little influence on the critical temperature for ordering (4C-6, Feb. 1949). Silver, on the other hand, lowers the critical temperature markedly (4C-43, June 1949).

The use of neutron diffraction to supplement X-ray diffraction is useful in studying ordering in some alloy systems, such as Fe-Co, where X-rays cannot distinguish between atoms of slightly different atomic number (4A-40, May 1949). Another application is in locating the positions of very light atoms in structures of compounds.

An outstanding contribution to the theory of ternary alloy systems is represented by research at the University of Birmingham by Raynor and associates. This program, which is concerned with equilibrium relations in ternary alloys based on copper, silver, and gold, is an outgrowth of the early work of Hume-Rothery on the electron-atom ratios of intermetallic compounds. In the ternary system Ag-Mg-Sn (4C-71, Sept. 1949), the electron compounds AgMg and Ag_3Sn, both of which have an electron:atom ratio of 3:2, enter into equilibrium with the silver-rich solid solution. In binary systems the 3:2 electron compounds can have body-centered cubic, hexagonal close-packed, or beta manganese structures. Increasing size factor of the solute atom with respect to the solvent atom favors the body-centered cubic structure, while increasing solute valency favors the hexagonal close-packed. In the Ag-Mg-Sn system, the high valency of tin should favor the hexagonal close-packed structure, but the low valency of magnesium should favor the cubic. It would be expected that this conflict in tendencies should reinforce the influence of the size factor. In confirmation of this, it is found that the range of stability of the hexagonal Ag_3Sn phase covers a range of size factors close to those in the binary systems.

The solution of tin in the AgMg superlattice is especially interesting. For low-tin solubility at some Ag:Mg ratios, the tin atoms are distributed statistically in the Ag and Mg positions but with further solubility at other ratios, the tin atoms take ordered positions, producing a superlattice of the type existing in the Heusler alloy Cu_2MnAl. At 450° C., the order-

ing of tin disappears, while the AgMg superlattice is retained up to its melting point.

Numerous crystal-structure determinations of intermetallic compounds are reported in the FIAT Reviews of German literature from 1939 to 1946 (4A-71, Sept. 1949), and also in new work published in the West German journal *Metallforschung*. Further crystal-structure determinations have been reported for uranium, thorium, and beryllium compounds.

Aluminum Alloys

Another important program being carried on by Raynor and colleagues includes the study of the constitution of aluminum-rich ternary systems. The unusual behavior of the transitional metals chromium, manganese, iron, cobalt, and nickel in aluminum alloys has suggested a theory of ternary compounds containing aluminum and transitional metals. An account of the development relating to the Raynor theory in the past year fits together as a satisfying story.

Briefly, the Raynor theory says that in alloys with aluminum, the transition metals chromium, manganese, iron, cobalt, and nickel act as electron acceptors by filling up the vacancies in their atomic orbitals. In other words, the five elements of the series from chromium to nickel absorb from a structure as a whole 4.66, 3.66, 2.66, 1.71, and 0.61 electrons per atom, respectively. These numerical values are the ones calculated by Pauling for the number of vacancies per atom in the atomic orbitals of this series of transition metals. Thus, the electron:atom ratio of a compound of the Al-Mn-Zn system is calculated by assuming that aluminum and zinc contribute three and two electrons per atom, respectively, while manganese absorbs 3.66 electrons per atom (or has a negative valency of 3.66).

An analogous series of ternary compounds in alloys of aluminum and manganese with copper, nickel, and zinc is based upon the simultaneous satisfaction of an electron:atom ratio of 1.85 and a ratio of 4 aluminum atoms to one solute atom. Whether or not the second condition can be satisfied in any other ternary system depends upon the atomic-size relationships involved. No such compound is formed in the Al-Mn-Mg and Al-Mn-Ag systems because the magnesium and silver atoms are too large to substitute for copper in the $MnAl_4$ structure (4D-4, Feb. 1949). Instead, a ternary compound designated as T(MnMg) is observed in the Al-Mn-Mg system with a ratio 2.37, corresponding to ternary compounds of similar electron:atom ratios in the Al-Fe-Si and Al-Cr-Mg systems.

In the family of systems of Al-Cu-transitional metal, the analogous ternary compounds were found consisting of $FeCu_2Al_7$, $NiCu_2Al_8$, and $Co_2Cu_5Al_{18}$ (which is almost $Co_2Cu_5Al_{13}$ and therefore has nearly a multiple of the number of atoms of $FeCu_2Al_7$) (4D-45, Sept. 1949). In the compound formulas, the substitution of iron for nickel in the structure increases the number of vacancies in the transitional metal atoms by approximately two. In substantiation of the Raynor theory, the increase in the number of vacancies in the structure is compensated for by adding one aluminum atom and subtracting one copper atom.

Perhaps the most spectacular achievement of the Raynor theory was the prediction of the general form of the aluminum-rich Al-Fe-Co diagram from those of the Al-Fe-Ni and Al-Co-Ni systems (4d-41, 1948). On the Al-Fe and Al-Ni axes, the compounds $FeAl_3$ and $NiAl_3$ exist in equilibrium with the alpha phase, while in the Al-Fe-Ni system and the Al-Co system the analogous compounds $FeNiAl_9$ and Co_2Al_9 enter into equilibrium with alpha. When the isothermals of the Al-Fe-Co and Al-Co-Ni systems were distorted in a manner equivalent to plotting on a scale of electron:atom ratio, the resulting diagram was almost indistinguishable from the corresponding Al-Fe-Ni isothermal.

The climax to the development of the Raynor theory was reached when the structure of Co_2Al_9 was accurately determined by Douglas of Cambridge (4d-42, 1948). In the Fourier synthesis made for this determination, the cobalt atoms were found to have about two electrons more than the normal number of 27. A still more conclusive calculation from the structure showed that the bounding planes of the Brillouin zone are touched by the Fermi sphere when 2.12 electrons per atom are present, which is in good agreement with an expected value of 2.125. The value of 2.125 electrons, though not mentioned in the description of the Raynor theory given above, is the number of electrons per unit volume when the usual absorption of 1.71 vacancies per atom of cobalt is assumed. Thus, an important amendment is being added to the Hume-Rothery rule.

Lecture on Atomic Energy Is Sobering, Encouraging

Reported by Wilhelm Olson

Atwood Vacuum Machine Co.

A lecture both sobering and encouraging was presented before the Rockford Chapter A.S.M. when Ernest E. Thum, editor of *Metal Progress*, spoke on "Implications of Atomic Energy" on Oct. 3. (See November *Metals Review* for detailed report of the talk.)

A special effort was made to interest the public in this meeting, and quite a number of visitors attended, among them several teachers on secondary and college levels. After preparing an academic foundation for the subject, Mr. Thum discussed the various aspects of the atomic field most profitably.

Steel-Clad Brick Has Wide Use in Furnace Structures

Reported by D. E. Young

Geneva Steel Co.

Steel-clad brick has wide use in many furnace constructions, M. A. Fay, ceramics engineer, research department, General Refractories Co., said in a talk given at the September meeting of the Utah Chapter A.S.M.

Although the silica brick now produced is superior to the prewar article—mainly because of more critical selection and more thorough cleaning of raw materials—the trend in melting furnace construction favors the increasing use of basic brick, Mr. Fay said. The latter is, of course, more expensive in first cost, but its use is usually justified by the following factors: *(a)* reduction of construction costs by reduction in volume of brick required, *(b)* longer life, *(c)* reduction of repair costs because of the simplicity, decreased frequency and decreased extent of repairs, *(d)* higher furnace production rates, *(e)* improvement in fuel rates, and *(f)* retardation of reaction between refractory and melt, reducing the amounts of materials charged.

Mr. Fay discussed at length the composition and properties of the various basic refractories, pointing out that though the first cost tends to favor the use of chemically bonded chrome-magnesite basic refractories, best service results are usually obtained from steel-clad magnesite-chrome brick, which is frequently more economical.

Steel-clad magnesite-chrome brick is becoming increasingly important and might eventually displace some other basic refractories now used, the speaker opined. Burned basic refractories and basic refractories especially developed for basic roof constructions were described.

Much research is now in progress to determine the exact nature of the reactions between the refractory material and the steel jacket of the steel-clad brick. While these reactions are not completely understood, it is known that the steel oxidizes and diffuses into the refractory to form an almost monolithic surface which bonds adjacent brick together and reduces spalling.

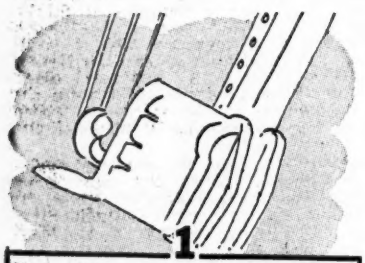
Furnaces and refractories are being improved continually through the interchange of ideas and practices between many industries. Since furnaces are becoming more complex in design and in the refractories used, the construction and repair of furnaces demand increasingly careful supervision.

Eleven new members, all from the Pacific States Cast Iron Pipe Co., were welcomed into the chapter at the first meeting of the season.

A. S. M. Review of Current Metal Literature

An Annotated Survey of Engineering, Scientific and Industrial Journals and Books Here and Abroad, Received During the Past Month

Prepared in the Library of Battelle Memorial Institute, Columbus, Ohio
W. W. Howell, Technical Abstractor



1 ORE BENEFICIATION and RESERVES

1A—General

1A-56. A Study of Present-Day Grinding. L. E. Djingheuzian. *Canadian Mining and Metallurgical Bulletin*, v. 42, Oct. 1949 (*Transactions of the Canadian Institute of Mining and Metallurgy*, v. 52), p. 555-569; discussion, p. 569.

Critical analysis and correlation of work on the fundamental principles of grinding, i.e., ball milling or similar procedures for reducing the particle size of ores and other lump-form solids. 60 ref.

1A-57. Discussion. B. Minerals Beneficiation. *Mining Engineering* (Transactions Section), v. 1 (*Transactions of the American Institute of Mining and Metallurgical Engineers*, v. 184), p. 404-406.

Deals with three recent AIME papers.

1A-58. New Processes for the Utilization of Low Grade Ores. R. W. Diamond, C. O. Swanson, and B. P. Sutherland. *Canadian Chemistry and Process Industries*, v. 33, Oct. 1949, p. 887-890, 892-893.

New advances in the processing of simple and complex low-grade ores.

1A-59. Massnahmen zur Verscheissminderung in sieblosen Kugelmühlen. (Methods for Decreasing Wear in Sieveless Ball Mills.) Hans-Joachim Salau. *Zeitschrift für Erzbergbau und Metallhüttenwesen*, v. 1, May 1948, p. 50-52.

Plant experiments showed that by substituting every other steel lining member with beechwood members, wear of the linings is decreased and life is greatly prolonged.

1A-60. (Book) Minerals and Mineral Deposits. W. R. Jones and David Williams. 248 pages. 1948. Oxford University Press, London, England. 5s., net.

Three introductory chapters deal with generalities, minerals in world history before the industrial age, and the composition of the earth's crust. Three chapters are devoted to mineralogical science. Next chapters are on minerals and rocks; economic mineral deposits; distribution and production of some of the chief metalliferous mineral deposits; the search for mineral deposits; and the extraction of minerals and metals. Final chapters are on minerals in the industrial age and some international aspects of mineral resources.

1B—Ferrous

1B-62. A Look at the Iron Ore Situation. T. L. Joseph and E. P. Pfleider. *Blast Furnace and Steel Plant*, v. 37, Oct. 1949, p. 1195-1198.

Extensive analysis of the various factors involved. Graphs and tables show past performance and projected trends.

1B-63. Erie Mining Co. Continues Taconite Research on Mesabi Iron Range. *Skillings' Mining Review*, v. 38, Oct. 22, 1949, p. 1-2.

The preliminary concentration plant, flow diagrams.

1B-64. Heavy Media Concentrator at Grant Iron Mine—Mesabi Range. A. N. Wold. *Skillings' Mining Review*, v. 38, Oct. 29, 1949, p. 1, 4.

1B-65. Die Grundlagen der wirtschaftlichen Verarbeitung von Rotschlamm. (The Principles of the Economical Processing of Red Mud.) (Concluded.) Friedrich Vogel. *Metall*, v. 3, Aug. 1949, p. 260-262.

A chemical method of converting the iron oxide in red mud into FeS which then is reduced to iron by electrolysis. TiO_2 is obtained as a by-product. 17 ref.

1C—Nonferrous

1C-75. Laboratory Experiments on Aluminum and Zinc Dusts as Precipitants of Gold in Cyanidation Practice. W. Hutchings. *Canadian Mining Journal*, v. 70, Oct. 1949, p. 74-79.

Experiments which show that Al dust is an effective precipitant of gold under many conditions where Zn dust is not. Use of Al dust may prove to be the solution of a great many mill operators' problems. 15 ref.

1C-76. Physical Chemistry of Precipitation Accelerators. H. L. Noblitt. *Canadian Mining Journal*, v. 70, Oct. 1949, p. 87-89.

Basic principles applied to the precipitation of cyanided precious metals by Zn dust.

1C-77. Factors Affecting the Rate of Formation of Zinc Ferrite From Zinc Oxide and Ferric Oxide. D. W. Hopkins. *Bulletin of the Institution of Mining and Metallurgy*, Oct. 1949, p. 1-21.

See abstract from *Journal of the Electrochemical Society*, item 1C-69, 1949.

1C-78. Milling Practice on the Golden Mile. S. G. Salamy. *Deco Trefoil*, v. 13, Sept.-Oct. 1949, p. 7-14.

Previously abstracted from *Mine & Quarry Engineering*. See item 1C-35, 1949.

1C-79. Depression of Pyrite and Arsenopyrite During Flotation in a Basic Medium. (In Russian.) I. N. Plaksin and A. M. Okolovich. *Izvestiya Akademii Nauk SSSR, Otdelenie Tekhnicheskikh Nauk* (Bulletin of the Academy of Sciences of the USSR, Section of Technical Sciences), June 1949, p. 907-922.

The action of bases [NaOH and Ca $(OH)_2$] as depressors. Activation of arsenopyrite by copper ions (from $CuSO_4$).

1C-80. Rare Earth Metals in "Mass" Production. *Product Engineering*, v. 20, Nov. 1949, p. 120.

Method used to separate and purify the rare metals formed by uranium fission. Ion-exchange-resin columns, 8 ft. tall and 4 in. diam. are used. Oxides of more than 99% purity are produced, then "smelted" to produce tiny ingots—tiny 1/20-oz. cylinders of praseodymium and neodymium and comparatively massive 1.3-lb. chunks of cerium and lanthanum.

1C-81. The Metallurgy of Cobalt. W. H. Dennis. *Mining Magazine*, v. 81, Sept. 1949, p. 144-146; Oct. 1949, p. 215-218.

Extraction of Co and its uses.

1C-82. Concentration of Oxide Manganese Ores From Payday No. 1 and Newcomb Properties, Weber and Rich Counties, Utah. J. A. McAllister and Walter J. Long, Jr. *U. S. Bureau of Mines*, Report of Investigations No. 4524, Sept. 1949, 9 pages.

Methods of concentration.

1C-83. Treatment of Gold Ore From the Ambassador and Vanderbilt Lodes, Cowarra Mine, Cowra Creek, N. S. W. K. S. Blaskett and H. H. Kunkin. *Metallurgical Laboratory, University of Melbourne*, Ore-Dressing Investigation No. 317, Jan. 20, 1949, 13 pages.

Compares ore samples from the Ambassador and Vanderbilt lodes with those from the Cowarra mine as to analysis and cyanidation.

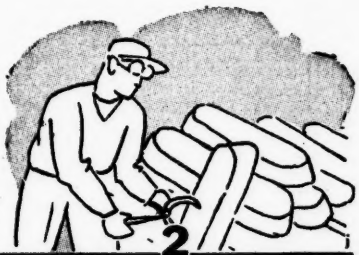
1C-84. (Book) Gold Extraction for the Small Operator. Ed. 2. 103 pages. Imperial Chemical Industries, Ltd., London, England.

History and brief details of the principal rock formations in which gold appears. Crushing and grinding, amalgamation, use of strakes, refining of bullion, leaching with cyanide solutions, testing of such solutions, precipitation, filling and dressing of zinc boxes, clean-up, acid treatment, and smelting of the precipitate. Concentration and flotation and special

methods for the treatment of difficult ores. Safety measures in handling cyanide, conversion tables, tank capacities, and other useful data.

1C-85. (Book) A Tantalita do Nordeste; Sua Exportacao e Analise. (Tantalites of Northeastern Brazil; Their Exportation and Analysis.) Morris Slavia, Cássio Mendonca Pinto, and Mário da Silva Pinto. 75 pages. 1946. Laboratorio da Producao Mineral, Departmento Nacional da Producao Mineral, Ministério da Agricultura, Rio de Janeiro, Brazil. (Bulletin No. 21.)

Statistical information concerning tantalite deposits; export regulations; development of an improved Schoeller method for determination of Ta in tantalites. Also a rapid method for classification of the ores based on relationship of specific gravity and Ta_2O_5 content.



2 SMELTING, REDUCTION and REFINING

2A—General

2A-11. Investigation of Ingot Solidification in Connection With Distribution of Temperatures. (In Russian.) V. M. Breitman. *Doklady Akademii Nauk SSSR* (Reports of the Academy of Sciences of the USSR), new ser., v. 66, June 1, 1949, p. 633-636.

Method of approximate calculation of movement of the crystallization front in a cylindrical ingot, having minimum information concerning temperature distribution. This method permits determination of the rate of growth of the solidifying outside layer on the basis of temperature changes within the layer and on its surface. As examples, calculations are presented for a paraffin block and for two steel ingots.

2A-12. Physico-Chemical Principles in Process Metallurgy. Charles F. Goodeve. *Faraday Society*, "The Physical Chemistry of Process Metallurgy," Discussion No. 4, 1948, p. 9-23.

Previously abstracted from *Faraday Society Transactions*, Preprint. See item 2a-21, 1948.

2A-13. Activities in Liquid Metallic Solutions. John Chipman. *Faraday Society*, "The Physical Chemistry of Process Metallurgy," Discussion No. 4, 1948, p. 23-49; discussion, p. 108-126.

Previously abstracted from *Faraday Society Transactions*, Preprint. See item 2a-22, 1948.

2A-14. Roasting and Reduction Processes—A General Survey. C. W. Dannatt and H. J. T. Ellingham. *Faraday Society*, "The Physical Chemistry of Process Metallurgy," Discussion No. 4, 1948, p. 126-139; discussion, p. 217-244.

Previously abstracted from *Faraday Society Transactions*, Preprint. See item 2a-20, 1948.

2A-15. Studies in the Thermodynamics of Metallurgical Reduction Processes by Electrochemical Methods. B. A. Rose, G. J. Davis, and H. J. T. Ellingham. *Faraday Society*, "The Physical Chemistry of Process Metallurgy," Discussion No. 4, 1948, p. 154-162; discussion, p. 217-244.

Previously abstracted from *Faraday Society Transactions*, Preprint. See item 2a-19, 1948.

2A-16. A Kinetic Study of the Dissociation of Carbon Monoxide Accompanying the Reduction of Metallic Oxides. A. Juliard, R. Rayet, and A. Ludé. *Faraday Society*, "The Physical Chemistry of Process Metallurgy," Discussion No. 4, 1948, p. 193-196; discussion, p. 217-244. Translated from the French.

Previously abstracted from *Faraday Society Transactions*, Preprint. See item 2a-15, 1948.

2A-17. The Reduction of Zinc Sulphide by Iron Under Reduced Pressure. P. Gross and M. Warrington. *Faraday Society*, "The Physical Chemistry of Process Metallurgy," Discussion No. 4, 1948, p. 215-217; discussion, p. 217-244.

Previously abstracted from *Faraday Society Transactions*, Preprint. See item 2a-16, 1948.

2B—Ferrous

2B-280. Concentrated Oxygen in Open Hearth Furnaces. W. Trinks. *Industrial Heating*, v. 16, Oct. 1949, p. 1738, 1740.

Advantages and disadvantages. Need for cut-back of oxygen feed in the latter part of the heat to prevent serious refractory damage.

2B-281. World's Largest Open Hearth Is Completed by Weirton Steel. *Iron and Steel Engineer*, v. 26, Oct. 1949, p. 89.

Dimensional data.

2B-282. Factors Affecting Open Hearth Production. C. L. Altenberger. *Iron and Steel Engineer*, v. 26, Oct. 1949, p. 96-98; discussion, p. 98.

2B-283. The Effect of Sodium Oxide Additions to Steelmaking Slags. Part I. Use of Soda to Dephosphorize Pig Iron at 1400° C. W. R. Maddocks and E. T. Turkdogan. *Journal of the Iron and Steel Institute*, v. 162, July 1949, p. 249-264.

Soda was added to basic and acid slags with the object of bringing about dephosphorization at low temperatures. In basic slags it was found impossible to retain soda as a silicate, which is necessary for formation of sodium phosphate. With slags containing up to 50% silica and a low $CaO-SiO_2$ ratio, dephosphorization took place after melting on acid hearths. Under favorable conditions as much as 85% dephosphorization of a 1.34% phosphorus iron was achieved.

2B-284. Investigations on an Experimental Blast-Furnace. H. L. Saunders, G. B. Butler, and J. M. Tweedy. *Journal of the Iron and Steel Institute*, v. 163, Oct. 1949, p. 173-206.

General layout and design of tuyeres, blast heater, sampling probes, and compensated charging mechanism. Main object of the work was to determine the manner in which temperature and CO_2 distribution in the stack are influenced by changing the segregation of the ingoing materials. Experimental data are interpreted in relation to the blast-furnace process.

2B-285. Pressure Operation; Modern Trends in Blast Furnace Practice. J. M. Ridgion. *Iron and Steel*, v. 22, Oct. 1949, p. 443-447.

Results of American work as disclosed by published literature and personal inquiry. 18 ref.

2B-286. Steel Production; A Summary of German Wartime Practice. *Iron and Steel*, v. 22, Oct. 1949, p. 463-465. Condensed from Section 11, BIOS Overall Report No. 15, "German Ferrous Metal Industry".

Basic bessemer, openhearth and electric steel practice in Germany during the war; differences between German and British or American practice. Wartime expedients to overcome shortages of materials and equipment.

2B-287. Fer électrolytique. (Electrolytic Iron.) Ch. Tschäppät. *Schweizer Archiv für angewandte Wissenschaft und Technik*, v. 15, Aug. 1949, p. 225-242.

Principles of direct electrolytic manufacture of 0.05-0.3 mm. sheets, eliminating melting and rolling operations. This material is especially valuable in manufacture of electrical machinery. Commercial method. Electrical, chemical, and mechanical properties. 26 ref.

2B-288. Su alcune osservazioni statistiche circa il tenore d'assigeno durante l'affinazione dell' acciaio. (Statistical Data Concerning the Amount of Oxygen Used During Refining of Steel.) Adolfo Antionioli. *La Metallurgia Italiana*, v. 41, Mar.-Apr. 1949, p. 71-79.

Statistical analysis and correlation of data from the literature, based on two assumptions concerning the mechanism of the action of carbon during steelmaking. Influence of different factors.

2B-289. Influenza del minerale agglomerato nella carica dell' alto forno. (Influence of Agglomerated Ore in the Blast-Furnace Charge.) Cornello Ricci. *La Metallurgia Italiana*, v. 41, May-June 1949, p. 121-127.

Operating results for three types of charge: lumps of Cogne magnetite; 50% lumps plus 50% ore sintered with blast-furnace gas; and 62.5% lumps plus 37.5% sintered briquets. The results are subjected to a critical mathematical analysis.

2B-290. Soufflage d'un convertisseur Thomas a l'air enrichi en oxygène. Essais exécutés aux forges de la Providence à Rehon. (Blowing a Bessemer Converter With Oxygen-Enriched Air. Experiments Conducted in the Providence Mill at Rehon.) M. Cornet. *Circulaire d'Informations Techniques*, v. 6, Apr.-May 1949, p. 185-209.

Factors investigated were: blowing a "cold" melt; nitrogen content of the steel; quality of the metal; blowing period; and proportion of ferroalloys which can be incorporated.

2B-291. Oxygenated Steel. *Industrial and Engineering Chemistry*, v. 41, Nov. 1949, p. 16A, 18A.

Present status of use of oxygen in steelmaking.

2B-292. Relative Reducibility of Some Iron Oxide Materials. E. P. Barrett and C. E. Wood. *U. S. Bureau of Mines*, Report of Investigations 4569, Oct. 1949, 17 pages.

Measurement of reducibility, preparation of materials for deoxidation tests, and test procedure. Variables affecting deoxidation.

2B-293. Influence of Free Carbon on Interphase Surface Tension in the System Silicate—Iron Sulfide. (In Russian.) A. A. Leont'eva. *Kolloidnyi Zhurnal* (Colloid Journal), v. 11, May-June 1949, p. 176-177.

Interphase surface tension is about 15 times higher in a reducing atmosphere than in carbon crucibles in the same furnace. This is believed due to desorption of pulverized carbon particles and their reaction with iron sulfide and silicate.

2B-294. How To Conserve Manganese. J. C. Vignos. *Journal of Metals*, v. 1, sec. 1, Nov. 1949, p. 20-21.

Advantages and disadvantages of various methods in steelmaking.

2B-295. Relative Deoxidizing Powers of Some Deoxidizers for Steel. C. E. Sims, H. A. Saller, and F. W. Boulger. *Journal of Metals* (Transactions Section), v. 1, Nov. 1949 (*Transactions of the American Institute of Mining and Met-*

allurgical Engineers, v. 185), p. 814-824; discussion, p. 824-825.

In experimental work to test the deoxidizing powers of commonly available elements, Mn, V, and Ca were found to be no stronger than Si. None of these is able to reduce the FeO content of steel sufficiently to form Type II sulfides. Mg is disqualified from a practical standpoint. Al, Zr, Ti, and B all are capable of producing Type II sulfides. The theory that deoxidation is primarily a homogeneous reaction involving monoxides of Fe and the deoxidizing element is expounded. 15 ref.

2B-296. Evaluation of pH Measurements With Regard to the Basicity of Metallurgical Slag. Charles W. Sherman and N. J. Grant. *Journal of Metals* (Transactions Section), v. 1, Nov. 1949 (*Transactions of the American Institute of Mining and Metallurgical Engineers*, v. 185), p. 898-903.

pH of ferrous slag extracts was studied over a wide range of slag compositions from neutral bisilicate slags of the blast-furnace type to highly basic slags achieved in the openhearth process. It was found that pH of an aqueous solution extracted from powdered slags varies directly with the number of mols of excess CaO present in the sample. The quantity, excess CaO, was found to be useful in estimating the desulfurizing power of certain MnO-free blast-furnace slags.

2B-297. Vyroba litiny s upravenou grafitisaci. (The Production of Modified Graphite Cast Irons.) Jiri Mackievic. *Hutnické Listy*, v. 4, July 1949, p. 210-217.

Reviews foreign and domestic literature.

2B-298. Control of Openhearth Slags on the Basis of the pH Values of Their Water Suspensions. (In Russian.) M. S. Kovtun and A. D. Ogorodnyaya. *Zavodskaya Laboratoriya* (Factory Laboratory), v. 15, Aug. 1949, p. 994-996.

Possibility of characterizing composition of slag according to its pH value.

2B-299. The Activity of Sulphur in Liquid Iron; The Influence of Carbon. J. A. Kitchener, J. O'M. Bockris, and A. Liberman. *Faraday Society*, "The Physical Chemistry of Process Metallurgy," Discussion No. 4, 1948, p. 49-60; discussion, p. 108-126.

Previously abstracted from *Faraday Society Transactions*, Preprint. See item 2b-182, 1948.

2B-300. The Reduction of Oxides of Iron as a Diffusion-Controlled Reaction. S. E. Woods. *Faraday Society*, "The Physical Chemistry of Process Metallurgy," Discussion No. 4, 1948, p. 184-193; discussion, p. 217-244.

Previously abstracted from *Faraday Society Transactions*, Preprint. See item 2b-183, 1948.

2B-301. Some Correlations Between Variables Affecting Sulphur in Blast Furnace Iron. T. E. Brower and B. M. Larsen. *Transactions of the American Institute of Mining and Metallurgical Engineers*, v. 176, 1948, p. 330-342.

Previously abstracted from *Metals Technology*. See item 2b-210, 1948.

2B-302. Note on the Distribution of Sulphur Between Molten Iron and Slag. Terkel Rosenqvist. *Transactions of the American Institute of Mining and Metallurgical Engineers*, v. 176, 1948, p. 541-542.

Previously abstracted from *Metals Technology*. See item 2b-208, 1948.

2B-303. The Constitution and Thermodynamics of Liquid Slags. F. D. Richardson. *Faraday Society*, "The Physical Chemistry of Process Metallurgy," Discussion No. 4, 1948, p. 244-257; discussion, p. 317-344.

Previously abstracted from *Faraday Society Transactions*, Preprint. See item 2a-13, 1949.

2B-304. The Thermodynamic Activity of Silica and of Oxides in Silicate Melts. M. Rey. *Faraday Society*, "The Physical Chemistry of Process Metallurgy," Discussion No. 4, 1948, p. 257-265; discussion, p. 317-344.

Previously abstracted from *Faraday Society Transactions*, Preprint. See item 2a-14, 1948.

2B-305. The Electrical Conductivity of Silicate Melts: Systems Containing Ca, Mn and Al. J. O'M. Bockris, J. A. Kitchener, S. Ignatowicz, and J. W. Tomlinson. *Faraday Society*, "The Physical Chemistry of Process Metallurgy," Discussion No. 4, 1948, p. 265-281; discussion, p. 317-344.

For the range 1000-1800° C. Method of investigation and results of previous work. Mechanism of conduction. A tentative model of silicate melts containing metal oxides. Application of this model to several systems. 36 ref.

2B-306. Equilibrium Relationships in Systems Containing Iron Oxide and Their Bearing on the Problem of the Constitution of Liquid Open-Hearth Slags. P. Murray and J. White. *Faraday Society*, "The Physical Chemistry of Process Metallurgy," Discussion No. 4, 1948, p. 287-296; discussion, p. 317-344.

Previously abstracted from *Faraday Society Transactions*, Preprint. See item 2b-179, 1948.

2B-307. The Behaviour of Oxygen in Liquid Steel During the Refining Period in the Basic Open-Hearth Furnace. S. Fornander. *Faraday Society*, "The Physical Chemistry of Process Metallurgy," Discussion No. 4, 1948, p. 296-307; discussion, p. 317-344.

Previously abstracted from *Faraday Society Transactions*, Preprint. See item 2b-181, 1948.

2B-308. The Physical Chemistry of Sulphur Removal in Steel Making. P. T. Carter. *Faraday Society*, "The Physical Chemistry of Process Metallurgy," Discussion No. 4, 1948, p. 307-316; discussion, p. 317-344.

Previously abstracted from *Faraday Society Transactions*, Preprint. See item 2b-180, 1948.

2B-309. Direct Oxidation in the Basic Open Hearth Process. E. B. Hughes and F. G. Norris. *Transactions of the American Institute of Mining and Metallurgical Engineers*, v. 176, 1948, p. 52-68; discussion, p. 68-77.

Previously abstracted from *Metals Technology*. See item 2b-132, 1948.

2B-310. Operation of Oxygen-Enriched Open-Hearth Furnaces. J. S. Marsh. *Transactions of the American Institute of Mining and Metallurgical Engineers*, v. 176, 1948, p. 78-89; discussion, p. 89-91.

Previously abstracted from *Metals Technology*. See item 2b-167, 1948.

2B-311. Role of Thermochemical Factors in Basic Open Hearth Production Rate. T. E. Brower and B. M. Larsen. *Transactions of the American Institute of Mining and Metallurgical Engineers*, v. 176, 1948, p. 92-107.

Previously abstracted from *Metals Technology*. See item 2b-209, 1948.

2B-312. Structure, Segregation and Solidification of Semikilled Steel Ingots. Michael Tenenbaum. *Transactions of the American Institute of Mining and Metallurgical Engineers*, v. 176, 1948, p. 108-163; discussion, p. 163-172.

Previously abstracted from *Metals Technology*. See item 2-240, 1947.

2B-313. A Quantitative Experimental Investigation of the Hydrogen and Nitrogen Contents of Steel During Commercial Melting. C. E. Sims, G. A. Moore, and D. W. Williams. *Transactions of the American Institute of Mining and Metallurgical Engineers*, v. 176, 1948, p. 260-278; discussion, p. 278-282.

Previously abstracted from *Metals Technology*. See item 2b-33, 1948.

2B-314. Kinetics of the Transfer of Sulphur Across a Slag-Metal Interface. Lo-ching Chang and K. M. Goldman. *Transactions of the American Institute of Mining and Metallurgical Engineers*, v. 176, 1948, p. 309-327; discussion, p. 327-329.

Previously abstracted from *Metals Technology*. See item 2b-131, 1948.

2C—Nonferrous

2C-81. Silver: Raw Material of the Electroplater. H. G. Dale. *Electroplating and Metal Finishing*, v. 3, Oct. 1949, p. 38-43.

History of silver production, extraction of the metal, and methods used to refine and prepare it for a plating anode.

2C-82. Segregation and Liquation of Alloys and Their Application to Nonferrous Metallurgy. Albert Portevin and Marc Dannenmuller. *Journal of the Institute of Metals*, v. 75, Aug. 1949, p. 949-972.

Surveys the various stages of solidification and the phenomena of segregation in alloys, under the headings of major segregation, minor segregation, and segregation after solidification. Major segregation is studied in detail. The second part deals with the industrial applications of segregation (liquation). Appendix describes briefly the procedure for the refining of commercial lead developed by Léon Jollivet. 19 ref.

2C-83. Kinetics of the "Cementation" Process. (In Russian.) B. V. Drozdov. *Zhurnal Prikladnoi Khimii* (Journal of Applied Chemistry), v. 22, May 1949, p. 483-490.

Refining process for separation of Ni from Cu, based on a substitution reaction known as cementation, and which takes place on the surfaces of grains of Ni powder in an electrolyte. Results of theoretical and experimental investigation of the process, including effect of NaCl in the electrolyte. 10 ref.

2C-84. Titanium Investigations: Research and Development Work on the Preparation of Titanium Chloride and Oxide From Titanium Mattes. R. G. Knickerbocker, C. H. Gorski, H. Kenworthy, and A. G. Starliper. *Journal of Metals* (Transactions Section), v. 1, Nov. 1949 (Transactions of the American Institute of Mining and Metallurgical Engineers, v. 185), p. 785-791.

Development of a new method for preparing lower-cost $TiCl_4$ for commercial production of ductile Ti and preparing TiO_2 pigment. Results indicate possibility of producing $TiCl_4$ and TiO_2 from rutile by smelting with pyrite and coke and then processing the titanium matte. An impure iron is recovered as a byproduct. Ilmenite may be treated in the same way. 10 ref.

2C-85. Recovery of Zinc by the Dithionate Sulphur-Dioxide Leaching Process. S. F. Ravitz. *Journal of Metals* (Transactions Section), v. 1, Nov. 1949 (*Transactions of the American Institute of Mining and Metallurgical Engineers*, v. 185), p. 792-795.

New process for treating oxidized Zn ores or low-grade Zn concentrates. Ore or calcined concentrate is leached with dilute SO_2, sulfate is precipitated by means of cyclic calcium dithionate, and Zn is recovered by precipitation with lime.

2C-86. La réduction du chlorure de glucinium par l'hydrogène. (Reduction of Beryllium Chloride by Hydrogen.) L. Hackspill and J. Besson. *Bulletin de la Société Chimique de France*, Jan.-Feb. 1949, p. 113-116.

It was found experimentally that

the temperature of the reduction is too near the melting point of the metal. Under such conditions, Be forms a low-melting alloy with tungsten. This difficulty has to be overcome, which is the goal of the research still in progress. 12 ref.

2C-87. Uber die Aufarbeitung von bleüschen Zwischenerzeugnissen im Kurztrommelofen. (Processing Lead-Containing Intermediates in a Short Revolving-Drum Furnace.) Jürgen Feiser. *Zeitschrift für Erzbergbau und Metallhüttenwesen*, v. 1, Apr. 1948, p. 21-28.

Design and operation of the furnace and how it can be used in various ways for extracting the components of the above.

2C-88. Raffination von Werkblei im Raffinieroffen. (Refining of Raw Lead in the Refining Furnace.) Reinhard Kleinert. *Zeitschrift für Erzbergbau und Metallhüttenwesen*, v. 2, Aug. 1949, p. 233-239; Sept. 1949, p. 274-277.

Sequence of formation of oxidation products, reactions of Sb with oxygen and metal oxides, possible methods of increasing rate of oxidation, and effect of operating conditions on results of the refining process. Second installment: The continuous refining process used in the lead works at Port Pirie in Australia. Possible reactions of antimony during the refining process. 14 ref.

2C-89. Die Zinkoxyd-Verblaseöfen der Unterharzer Bergund Hüttenwerke. (The Zinc Oxide Blast Furnace of the Unterharz Mining and Smelting Plant.) Hans-Joachim Hellwig. *Zeitschrift für Erzebergbau und Metallhüttenwesen*, v. 2, Sept. 1949, p. 263-268.

New and improved installation for recovery of Zn and associated metals.

2C-90. Neuzeitliche elektrolytische Kupferraffination; Ihr Ausgangsmaterial und deren Nebenprodukte. (Modern Electrolytic Copper Refining; Final Product and By-Products.) Theodor Meissl. *Chemische Technik*, v. 1, Aug. 1949, p. 50-56.

A method of producing high-purity electrolytic copper and of extracting other metallic components from sludge.

2C-91. The Primary Reactions in Roasting and Reduction Processes. J. S. Anderson. *Faraday Society*, "The Physical Chemistry of Process Metallurgy," Discussion No. 4, 1948, p. 163-173; discussion, p. 217-244.

Previously abstracted from *Faraday Society Transactions*, Preprint. See item 2a-18, 1948.

2C-92. A New Method for Studying the Mechanism of Roasting Reactions. E. A. Peretti. *Faraday Society*, "The Physical Chemistry of Process Metallurgy," Discussion No. 4, 1948, p. 174-179; discussion, p. 217-244.

Previously abstracted from *Faraday Society Transactions*, Preprint. See item 2a-17, 1948.

2C-93. An Analysis of the Converting of Copper Matte. E. A. Peretti. *Faraday Society*, "The Physical Chemistry of Process Metallurgy," Discussion No. 4, 1948, p. 179-184; discussion, p. 217-244.

Previously abstracted from *Faraday Society Transactions*, Preprint. See item 2c-55, 1948.

2D—Light Metals

2D-29. Recovery of Aluminum From Crude Aluminum-Silicon Alloy by Extraction With Molten Zinc. Hillary W. St. Clair and D. D. Blue. *U. S. Bureau of Mines, Report of Investigations* 4535, Aug. 1949, 23 pages.

An experimental and economic study of practicability of refining crude Al-Si alloy or Al scrap containing Si and Fe by selective dissolution in Zn of the Al from the alloy, followed by distillation of Zn from Al. Feasibility was found to depend on finding a practicable and economical method of refining crude Al-Si alloy.

2D-30. Refining Metal Melts. Adaptation of Wet-Method Chemical Filtration. (Concluded.) Reinacher. *Metal Industry*, v. 75, Sept. 9, 1949, p. 211-213.

Recovery of Silumin and removal of oxide from the Al-Si system by liquation and filtration.

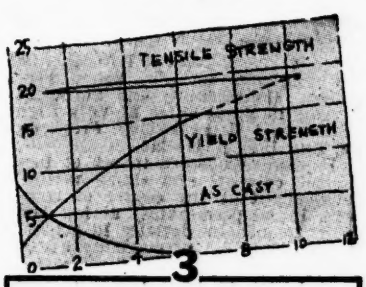
2D-31. The Vapour Pressure of Magnesium in the Thermal Reduction of MgO by Ferrosilicon. L. M. Pidgeon and J. A. King. *Faraday Society*, "The Physical Chemistry of Process Metallurgy," Discussion No. 4, 1948, p. 197-206; discussion, p. 217-244.

Previously abstracted from *Faraday Society Transactions*, Preprint. See item 2d-22, 1948.

2D-32. On Some Equilibria Involving Aluminium Monohalides. P. Gross, C. S. Campbell, P. J. C. Kent, and D. L. Levi. *Faraday Society*, "The Physical Chemistry of Process Metallurgy," Discussion No. 4, 1948, p. 206-215; discussion, p. 217-244.

Previously abstracted from *Faraday Society Transactions*, Preprint. See item 2d-21, 1948.

For additional annotations indexed in other sections, see: 1C-80; 3B-258; 14B-138; 15-73; 16D-4; 17-100



3 PROPERTIES

3A—General

3A-209. Magnetic Characteristics of an Oriented 50 Percent Nickel-Iron Alloy. J. H. Crede and J. P. Martin. *Journal of Applied Physics*, v. 20, Oct. 1949, p. 966-971.

Single-crystal magnetic properties were closely approached in a polycrystalline 50% Ni-Fe alloy by development of a favorable grain orientation. The method is adapted to commercial production by careful control of processes affecting the fundamental magnetization process. Hysteresis loops of nearly geometrically true rectangular shape were produced.

3A-210. Fretting Fatigue. Literature Report No. 1. George Sachs. *Journal of Scientific & Industrial Research*, v. 8, Aug. 1949, p. 329-333.

Literature survey. 57 ref.

3A-211. Magnetic Dispersion at Microwave Frequencies. G. F. Hodsman, G. Eichholz, and R. Millership. *Proceedings of the Physical Society*, v. 62, sec. B, June 1, 1949, p. 377-390.

Method for measurement of initial permeabilities of ferromagnetic wires in the microwave region, and successfully applied from 3-13 cm. wavelength to a variety of materials. Results are interpreted in the light of modern theories of magnetic dispersion. An estimate of domain sizes is made. 24 ref.

3A-212. The Magnetostriction of Anisotropic Permanent Magnet Alloys. M. McCaig. *Proceedings of the Physical Society*, v. 62, sec. B, Oct. 1, 1949, p. 652-656.

Blocks of permanent magnet alloys of the system Fe-Ni-Al-Co-Cu were prepared with columnar crystals. Magnetostriction was measured in various directions before and after heat treatment in a magnetic field. Results agree well with those predicted theoretically, and thus confirm the postulated crystal structure.

3A-213. Temperature and Metals. (Concluded.) *Edgar Allen News*, v. 28, Sept. 1949, p. 380-381.

Notes on the effect of temperature on certain properties of metals with particular reference to creep.

3A-214. Thermal Stresses Associated With Fatigue. (In Russian.) M. I. Rozovskii. *Zhurnal Tekhnicheskoi Fiziki* (Journal of Technical Physics), v. 19, June 1949, p. 696-710.

Mathematical analysis and calculations for symmetrically heated balls and spherical shells, and thin plates with uneven temperature distribution.

3A-215. Macro-Residual Stresses in Metals Resulting From Plastic Deformation. W. M. Baldwin, Jr. *American Society for Metals*, "Cold Working of Metals", 1949, p. 31-56.

For various cold-working operations. 14 ref.

3A-216. Plastic After Effects. J. G. Leschen. *American Society for Metals*, "Cold Working of Metals", 1949, p. 197-209.

Definition and the distinction from elastic after-effects. Discusses the phenomenon in terms of structure, including internal inhomogeneity and anisotropy of physical properties. 10 ref.

3A-217. Work Hardening Under Combined Stresses. L. R. Jackson. *American Society for Metals*, "Cold Working of Metals", 1949, p. 210-222.

The effect of average macro-straining. Concepts of shear-strain energy can be used to describe the plastic stress-strain curve. 13 ref.

3A-218. Creep of Metals. J. D. Lubahn. *American Society for Metals*, "Cold Working of Metals", 1949, p. 223-247.

Factors that may affect the shape of a strain-time curve. Suggests that strain-time relationships based upon fundamental characteristics of deformation should apply over a wide range of conditions. Limited to creep during which recovery and other transformations do not occur. 30 ref.

3A-219. Cold Work and Fatigue. Alfred M. Freudenthal. *American Society for Metals*, "Cold Working of Metals", 1949, p. 248-261.

Progressive damage, fatigue characteristics, and surface and fatigue performance. 15 ref.

3A-220. The Fracture Stress of Metals As Affected by Plastic Deformation, the Stress System, and Size. D. J. McAdam, Jr. *American Society for Metals*, "Cold Working of Metals", 1949, p. 321-364.

43 ref.

3A-221. Contributions to the Data on Theoretical Metallurgy. X. High-Temperature Heat-Content, Heat-Capacity, and Entropy Data for Inorganic Compounds. K. K. Kelley. *U. S. Bureau of Mines*, Bulletin 476, 1949, 241 pages.

Data on 70 different elements and their compounds; and tables and algebraic expressions for their representation. 599 ref.

3A-222. Magnetism. Francis Bitter. *Physics Today*, v. 2, Nov. 1949, p. 20-28.

Semi-popular exposition of the theory of magnetism. Properties and magnetic structures of the magnetic alloys.

3A-223. Strength of Engineering Ma-

terials. Gilbert Cook. *Engineer*, v. 188, Oct. 14, 1949, p. 424-426. Excerpts.

Fundamental considerations; the tensile test, plastic deformation, fracture, fatigue, and influence of size on strength properties.

3A-224. Laws of Magnetic Properties of Macro-Heterogeneous Magnetic-Solid Systems. (In Russian.) A. B. Al'tman, L. Sh. Kazarnovskii, and V. L. Nemelov. *Zhurnal Tekhnicheskoi Fiziki* (Journal of Technical Physics), v. 19, May 1949, p. 560-566.

Laws of residual induction and coercive force as a function of phase composition. Such laws permit evaluation of properties of metal-ceramic and metal-plastic compositions. Permanent magnets from the Fe-Ni-Al system with additions of Co, Cu, and K were investigated.

3A-225. Optical Constants of Ferromagnetic Substances. (In Russian.) S. V. Vonsovskii and A. V. Sokolov. *Zhurnal Eksperimental'noi i Teoreticheskoi Fiziki* (Journal of Experimental and Theoretical Physics), v. 19, July 1949, p. 615-620.

Relationship to spontaneous magnetization. Dielectric constants and specific electroconductivities are calculated in alternating electromagnetic fields, on the basis of a model of interacting external and internal electrons. These values are shown to be functions of spontaneous magnetization indicating existence of ferromagnetic "anomalies" of optical properties. Data are compared with those for long-wave-length radiation at temperatures close to the Curie point. 11 ref.

3A-226. Effect of Dislocation Upon Ferromagnetic Substances. (In Japanese.) Gunji Shinoda and Tokuzo Inouye. *Nippon Kinzoku Gakkai-Si* (Journal of the Japan Institute of Metals), v. 13, Jan. 1949, p. 5-8.

Mathematical analysis. Conclusions are outlined in the English abstract.

3A-227. An Equation Representing the Very Large Internal Stresses Accompanying the Transformation of Substances. (In Japanese.) Kotaro Honda. *Nippon Kinzoku Gakkai-Si* (Journal of the Japan Institute of Metals), v. 13, Jan. 1949, p. 13-16.

Compares theoretical and experimental values for Fe, Fe-Ni, and Mn alloys. Depression of the freezing point of water was also calculated.

3A-228. Relation Between Indentation Hardness and Strain for Metals. J. H. Palm. *Journal of Metals* (Transactions Section), v. 1, Nov. 1949 (*Transactions of the American Institute of Mining and Metallurgical Engineers*, v. 185), p. 804.

Experiments have shown that a certain formula expresses very well the relation between true stress and true strain for uniform monatomic deformation of plastic metals in single tension and compression. A similar formula might be valid for the relation between hardness and strain. Relations between true stress and true strain, and between Vickers hardness and true strain, are shown graphically.

3A-229. Some Experiences With the Creep Behaviour of Materials. A. Johansson. *Engineers' Digest*, v. 10, Oct. 1949, p. 340-342; discussion, p. 342-344. Translated and condensed from *Teknisk Tidskrift*, v. 79, Feb. 19, 1949, p. 127-132.

Service experience with high-temperature materials in steam turbines, gas turbines, and creep-testing machines.

3A-230. Die Spannungs-Dehnungskurve ferromagnetischer Werkstoffe (Magnetomechanische Hystereseschleife). [The Stress-Strain Curve of Ferromagnetic Materials (Magneto-Mechanical Hysteresis Curve).] Max Kornetzki. *Annalen der Physik*, ser. 6, v. 2, May 8, 1948, p. 265-269.

The relationship of torsion strength to torsion stress was determined for a soft nickel tube. Stress was applied cyclically, with stepwise increases in rate of application. Results show that relations between elongation and stress are exactly like those between magnetic induction and field strength. At very low amplitudes, variations of mechanical properties of ferromagnetic materials are parallel to those of the magnetic Rayleigh curve.

3A-231. Thickness of "Valence-Electron Atmospheres" and Electrode Potentials of Metals. (In Russian.) G. S. Koshurnikov. *Zhurnal Prikladnoi Khimii* (Journal of Applied Chemistry), v. 22, July 1949, p. 777-778.

Equation for relationship of the thickness of the layer of valence electrons to radius of metallic ions. Increase of standard electrode potentials of 18 metals with increase of thickness of this layer.

3A-232. Theory of Diagrams of Additive Deformation and Calculation of True Resistance to Rupture. (In Russian.) V. Ya. Shekhter. *Zavodskaya Laboratoriya* (Factory Laboratory), v. 15, Aug. 1949, p. 957-961.

Theoretically analyzes bases of the concept of additive deformation. Curves of additive deformation can be used for determination of true resistance to rupture. Typical determinations for a series of ferrous and nonferrous metals and alloys.

3A-233. Permeabilität und Wirbelströme in Blechkernen bei sehr hohen Frequenzen. (Permeability and Turbulent Currents in Sheet Cores at Very High Frequencies.) R. Feldtkeller. *Frequenz*, v. 3, Apr. 1949, p. 111-116.

Explains Wolman's theory of turbulent currents and shows mathematically that the course of complex initial permeability at low and high frequencies deviates in general from the initial permeability calculated for homogeneous sheet metal. The course of local initial permeability from surface to center of sheet is computed from the values of complex permeability.

3A-234. The Effect of Thermal-Mechanical History on the Strain Hardening of Metals. J. E. Dorn, A. Goldberg, and T. E. Tietz. *Transactions of the American Institute of Mining and Metallurgical Engineers*, v. 180, 1949, p. 205-224.

Previously abstracted from *Metals Technology*. See item 3a-118, 1948.

3A-235. Influence of Size and the Stress System on the Flow Stress and Fracture Stress of Metals. D. J. McAdam, Jr., G. W. Geil, D. H. Woodard, and W. D. Jenkins. *Transactions of the American Institute of Mining and Metallurgical Engineers*, v. 180, 1949, p. 363-381.

Previously abstracted from *Metals Technology*. See item 3a-62, 1948.

3A-236. Statistical Rate Theory of Metals. 1. Mechanism of Flow and Application to Tensile Properties. J. W. Fredrickson and H. Eyring. *Transactions of the American Institute of Mining and Metallurgical Engineers*, v. 180, 1949, p. 382-414.

Previously abstracted from *Metals Technology*. See item 3a-107, 1948.

3A-237. (Book) **Metallic Creep and Creep Resistant Alloys.** A. H. Sully. 278 pages. 1949. Interscience Publishers, New York.

Practical and theoretical aspects. Development of the existing theory of the strength of metals with special reference to creep, and certain metallurgical factors affecting creep. Experimental techniques and creep properties of ferrous and nonferrous alloys.

3A-238. (Book) **Permanent Magnets.** F. G. Spreadbury. Sir Isaac Pitman and Sons, Ltd., Parker St., Kingsway, London, W. C. 2, England. 35s. net.

Various magnetic materials in use in Britain. Places major emphasis on magnet design, although electromagnetism and magnetic theory are included where these subjects are relevant to permanent magnetism. Two final chapters are devoted to magnetization and demagnetization.

3A-239. (Book) **Problemy Ferromagnetizma i Magnetodinamiki.** (Problems of Ferromagnetism and Magnetodynamics.) V. K. Arkad'eva, editor. 175 pages. 1946. Section of Technical Sciences, Academy of Sciences of the U.S.S.R., Moscow and Leningrad.

Consists of 14 papers presented at a symposium held in Moscow in 1946, plus a series of diagrams for calculation of elastic and plastic permeability of plates and cylinders (p. 167-173). Papers are: "Magnetic Spectroscopy and Its Problems", V. K. Arkad'ev (p. 7-27); "Determination of Magnetic Permeability of Substances on the Basis of Their Effective Complex Magnetic Permeability by V. K. Arkad'ev's Method", K. M. Polivanov (p. 29-41); "Influence of Weiss Regions on the Relationship of Magnetic Permeability to Frequency", K. M. Polivanov (p. 43-54); "Investigation of Magnetic Properties of Iron Strips Used for Cable Shields", V. M. Goitannikov (p. 55-66); "Magnetic Spectra of Permalloy at Sonic Frequencies", A. I. Pil'shchikov (p. 67-72); "Determination of Magnetic Permeability of Ferromagnetic Conductors and Plates During Application of an Alternating Field", V. K. Arkad'ev and K. A. Volkova (p. 73-82); "Electrical Skin Effect in a Strip Having Complex Magnetic Permeability", V. K. Arkad'ev and A. A. Dobrovol'skaya (p. 83-87); "Reflection of Electrical Waves From a Hertz Grid, Parallel to the Magnetic Vector", O. I. Kozinets (p. 89-92); "Concerning Apparent Demagnetization", L. A. Yurovskii (p. 93-96); "Theory of Properties of Polycrystalline Ferromagnetics in Medium and Weak Magnetic Fields", E. I. Kondorskii (p. 97-127); "Limiting Demagnetization Factors in Cylinders", V. K. Arkad'ev (p. 129-132); "Derived Curves of Demagnetization According to Razumovskii for Different Materials", A. F. Matalin (p. 133-141); "Sensitivity of Residual Magnetization to External Fields", S. A. Khatyukov (p. 143-145); and "Distribution of Magnetic Flux in Rails During Their Magnetization by Means of the Rolling Electromagnet Used in Defect-Detection Instruments of the F. M. Karpov Type", K. M. Polivanov (p. 147-166).

3B—Ferrous

3B-228. Effect of Surface Roughness on Rolling Friction. J. J. Bikerman. *Journal of Applied Physics*, v. 20, Oct. 1949, p. 971-975.

Minimum tilt at which bearing balls roll down an inclined plate of stainless steel is greater for rough than for smooth surfaces. The roughest surfaces gave almost quantitative agreement between height of elevations and height of hills calculated from a theory attributing rolling friction to surface roughness. No similar agreement was observed for fine finishes. Elastic deformation of the surfaces in contact was irrelevant for coarse finishes. Capillary attraction presumably did not interfere, as superficial drying had no effect.

3B-229. Change of Electrical Resistance During the Strain Ageing of Iron. A. H. Cottrell and A. T. Churchman. *Journal of the Iron and Steel Institute*, v. 162, July 1949, p. 271-276.

It has been suggested that yield point and strain aging of α-iron are due to migration of C and N atoms to dislocations. One consequence of the theory is that electrical resistance should decrease by a small and roughly predictable amount on strain aging. This effect is shown to exist in soft-iron wire. Effect of increasing the temperature of aging and increasing the amount of cold work. 22 ref.

3B-230. The Diffuse Reflectivity of Oxide Layers Formed on Steels Under Defined Conditions. R. J. Donato. *Proceedings of the Physical Society*, v. 62, sec. B, Oct. 1, 1949, p. 629-638.

Method to determine reflectivity at various wavelengths in the visible spectrum and at different temperatures up to 660° C. Some results are given for the oxides of various steels. Application to theory and practice (pyrometry) is indicated. 11 ref.

3B-231. A Clinical Diagnosis on a Springmaker's Malady — Acid Brittleness. *Mainspring*, v. 13, Oct. 1949, unpaged.

Practical analysis of the problem and its solution. Acid brittleness of steel, otherwise known as hydrogen embrittlement, is usually created by absorption during pickling, and can be removed by one of many suitable combinations of time and temperature.

3B-232. Overvoltage of Hydrogen on Porous Iron. (In Russian.) L. L. Kuz'min and V. S. Poroikova. *Zhurnal Prikladnoi Khimii* (Journal of Applied Chemistry), v. 22, June 1949, p. 572-577.

The reduction of hydrogen overvoltage on electrodes with built-up surfaces of porous iron obtained by powder metallurgy was investigated. Influence of conditions of electrode production on potential. At high current densities, hydrogen overvoltage is approximately 0.3 volt less than on smooth iron.

3B-233. Strength of Carbon Steels at High Temperatures. (In Russian.) M. A. Zaikov. *Zhurnal Tekhnicheskoi Fiziki* (Journal of Technical Physics), v. 19, June 1949, p. 684-695.

Relationship of yield strength to temperature of annealing and melting point by experiments on fracture of test specimens of carbon steels containing 0.12-1.19% C. Formulas for computation of mechanical constants. Experimental method. Results for structural toolsteels for different temperature regions (20-1300° C.). 26 ref.

3B-234. Influence of Rate of Deformation on Strength of Carbon Steel at High Temperatures. (In Russian.) M. A. Zaikov. *Zhurnal Tekhnicheskoi Fiziki* (Journal of Technical Physics), v. 19, June 1949, p. 711-721.

Experiments on fracture of steel (0.08-0.15% C) at different rates of deformation and different temperatures (20-1150° C.) establish relationship of yield strength and constant of plastic deformation to temperature and rate of deformation. Agreement of rate coefficient with previously determined relationship of yield strength to temperature and chemical composition of steel is indicated. 30 ref.

3B-235. Viscosity of Molten Iron-Carbon Alloys. (In Russian.) A. M. Samarin and L. A. Shvartsman. *Izvestiya Akademii Nauk SSSR, Otdelenie Tekhnicheskikh Nauk* (Bulletin of the Academy of Sciences of the USSR, Section of Technical Sciences), June 1949, p. 891-899.

Relationship to composition and temperature was investigated. Viscosity of molten iron may be predicted approximately by the theory of transition states. Applicability of formulas of Bachenskii for composition and temperature dependence of viscosity.

3B-236. Comparative Creep Characteristics of Type 14-14 Chromium-Nickel and Chromium-Manganese Steel. (In Russian.) A. M. Borzdyka. *Izvestiya Akademii Nauk SSSR, Otdelenie Tekhnicheskikh Nauk* (Bulletin of the Academy of Sciences of the USSR, Section of Technical Sciences), June 1949, p. 900-906.

Investigated on four samples of Type 14-14 steel with 2.5% W, two being Cr-Ni base and two Cr-Mn base. Each pair included a low-carbon and a medium-carbon steel. The Cr-Mn austenite was found to have much higher (10-20%) thermal stability than the Cr-Ni. Thermal stability of Cr-Mn steel of the austenite-ferrite type is shown to be directly dependent on relative content of alpha and gamma phases.

3B-237. Concerning the Properties of Hot-Quenched High Speed Steels. (In Japanese.) Masazo Okamoto and Mituru Nagakura. *Nippon Kinzoku Gakkai-Si* (Journal of the Japan Institute of Metals), v. 13, Apr. 1949, p. 31-34.

The above were investigated with respect to hardness, specific gravity, microstructure, thermal expansion, and specific resistance.

3B-238. Research on Austenitic Stainless Steel of the Ni-Cr-Mn System. (In Japanese.) Yoshitaro Fuke. *Nippon Kinzoku Gakkai-Si* (Journal of the Japan Institute of Metals), v. 13, Apr. 1949, p. 34-37.

Purpose of investigation was to obtain alloys equal to 18-8 stainless in metallurgical properties, especially corrosion resistance, by addition of a fourth element. The elements Ti, Mo, V, Si, and Al were chosen for investigation. On this basis, 20 alloys were prepared and their mechanical properties and corrosion resistance determined. Results show superiority over 18-8 in two or three cases.

3B-239. How Chromium Plating Affects Fatigue Life of Aircraft Steels. *Steel*, v. 125, Nov. 7, 1949, p. 110-111, 142. A condensation.

Previously abstracted from *Journal of Research of the National Bureau of Standards*. See item 3B-219, 1949.

3B-240. La-Led: A New, Free-Machining Bar Steel. Glenn D. Boyer. *Screw Machine Engineering*, v. 11, Nov. 1949, p. 38-40.

A cold finished openhearth steel containing lead and 0.08-0.13% C is said to realize large savings on a variety of screw-machine parts by replacing bessemer and resulfurized openhearth steels.

3B-241. Growth of Cast Iron. W. C. Blott. *Iron Age*, v. 164, Nov. 10, 1949, p. 88-91.

Growth characteristics of a series of high-strength cast irons used for parts which may be subjected to elevated temperatures. Effects of various alloying additions.

3B-242. Production Data Sheet. *Production Engineering & Management*, v. 24, Nov. 1949, p. 65.

General engineering types of steel castings classified according to tensile strengths. Includes specifications.

3B-243. Low Temperature Fatigue Tests on Steel. Hempel. *Product Engineering*, v. 20, Nov. 1949, p. 125-127. Condensed from *Wright-Patterson Air-Force Base, Headquarters Air Matériel Command*, Translation F-TS-1855-RE. Translated from *Kaiser Wilhelm-Institut für Eisenforschung*, ZWB Report FB 1704/1, Dec. 18, 1942.

Results of tensile, fatigue, notched-bar impact, endurance limit, and hardness tests on a series of 14 aircraft structural steels.

3B-244. Influence of Transition from Static to Dynamic Tensile Stress on Character of Plastic Deformation of Steel. (In Russian.) B. A. Krupitskii. *Zavodskaya Laboratoriya* (Factory Laboratory), v. 15, July 1949, p. 831-834.

Character of distribution of plastic deformation among individual zones in the test specimen and the influence of transition from static to dynamic tensile stress on plastic deformation in these zones. Cr-Mo structural steel with different heat treatments was investigated as an example.

3B-245. Concerning the Dynamic Characteristics of the Magnetostrictive Alloy "Alfer". (In Japanese.) Hakaru Masumoto and Goro Otomo. *Nippon Kinzoku Gakkai-Si* (Journal of the Japan Institute of Metals), v. 13, Jan. 1949, p. 1-4.

Dynamic characteristics of Fe-Al alloys containing 6.36-14.38% Al were measured in fields of 5, 10, 15, and 20 oersteds. The two curves representing the relationships of magnetostrictive activity and sound velocity to concentration in a field of 10 oersteds have maxima and minima, respectively, in the range 12.2-13.4% Al. A small addition of Ni greatly increases magnetostrictive properties. Electro-acoustic efficiencies are of the same order as Ni—nearly 100%.

3B-246. Temper Brittleness of Si-Mn-Cr Steels. III. Effect of Manganese. IV. The Effect of Chromium. (In Japanese.) S. Koshiba and K. Nobara. *Nippon Kinzoku Gakkai-Si* (Journal of the Japan Institute of Metals), v. 13, Jan. 1949, p. 30-36.

Effects of 0.6-1.2% Mn and Cr were investigated and found to increase rapidly with Mn content. Maximum temper brittleness occurs at a tempering temperature of 600-650° C. For Cr, "first temper brittleness" was observed at over 0.80% Cr, and "second temper brittleness" increases rapidly with Cr content. For 0.8-1.2% Cr, temper brittleness is very large at a tempering temperature of 600° C.

3B-247. Concerning Grain Growth and Cutting Durability of High-Speed Steel. (In Japanese.) S. Koshiba. *Nippon Kinzoku Gakkai-Si* (Journal of the Japan Institute of Metals), v. 13, Jan. 1949, p. 36-40.

In high speed steel, grain growth is generally caused by "high" quenching temperature, value of the latter varying with heat treatment prior to quenching. Usually steel of smaller grain size is superior in cutting durability, but heat treating history must also be considered.

3B-248. Über die Temperaturabhängigkeit der Permeabilität und der Nachwirkung ferromagnetischer Werkstoffe. (The Temperature Dependence of Permeability and of After-Effect of Ferromagnetic Materials.) Hermann Fahlenbrach. *Annalen der Physik*, ser. 6, v. 2, June 15, 1948, p. 355-369.

Permeability vs. field strength and magnetic after-effects were measured for commercially "pure irons", and for Fe-Si, Fe-Ni, and Fe-Cr-Al alloys from 200° C. to the respective Curie points. A series of anomalous temperature ranges of permeability in which magnetic switch-off after-effects are found support Snoek's theory. With some exceptions, permeability values greatly increase with temperature up to near the Curie point. 11 ref.

3B-249. Influence of Cold Hardening by Application of Tensile Stress on Notch Plasticity During Bending. (In Russian.) P. O. Pashkov and M. D. Chernyshava. *Zhurnal Tekhnicheskoi Fiziki* (Journal of Technical Physics), v. 19, July 1949, p. 782-791.

terials. Gilbert Cook. *Engineer*, v. 188, Oct. 14, 1949, p. 424-426. Excerpts.

Fundamental considerations; the tensile test, plastic deformation, fracture, fatigue, and influence of size on strength properties.

3A-224. Laws of Magnetic Properties of Macro-Heterogeneous Magnetic-Solid Systems. (In Russian.) A. B. Al'tman, L. Sh. Kazarnovskii, and V. L. Nemelov. *Zhurnal Tekhnicheskoi Fiziki* (Journal of Technical Physics), v. 19, May 1949, p. 560-566.

Laws of residual induction and coercive force as a function of phase composition. Such laws permit evaluation of properties of metal-ceramic and metal-plastic compositions. Permanent magnets from the Fe-Ni-Al system with additions of Co, Cu, and K were investigated.

3A-225. Optical Constants of Ferromagnetic Substances. (In Russian.) S. V. Vonsovskii and A. V. Sokolov. *Zhurnal Eksperimental'noi i Teoreticheskoi Fiziki* (Journal of Experimental and Theoretical Physics), v. 19, July 1949, p. 615-620.

Relationship to spontaneous magnetization. Dielectric constants and specific electroconductivities are calculated in alternating electromagnetic fields, on the basis of a model of interacting external and internal electrons. These values are shown to be functions of spontaneous magnetization indicating existence of ferromagnetic "anomalies" of optical properties. Data are compared with those for long-wave-length radiation at temperatures close to the Curie point. 11 ref.

3A-226. Effect of Dislocation Upon Ferromagnetic Substances. (In Japanese.) Gunji Shinoda and Tokuzo Inouye. *Nippon Kinzoku Gakkai-Si* (Journal of the Japan Institute of Metals), v. 13, Jan. 1949, p. 5-8.

Mathematical analysis. Conclusions are outlined in the English abstract.

3A-227. An Equation Representing the Very Large Internal Stresses Accompanying the Transformation of Substances. (In Japanese.) Kotaro Honda. *Nippon Kinzoku Gakkai-Si* (Journal of the Japan Institute of Metals), v. 13, Jan. 1949, p. 13-16.

Compares theoretical and experimental values for Fe, Fe-Ni, and Mn alloys. Depression of the freezing point of water was also calculated.

3A-228. Relation Between Indentation Hardness and Strain for Metals. J. H. Palm. *Journal of Metals* (Transactions Section), v. 1, Nov. 1949 (*Transactions of the American Institute of Mining and Metallurgical Engineers*, v. 185), p. 804.

Experiments have shown that a certain formula expresses very well the relation between true stress and true strain for uniform monatomic deformation of plastic metals in single tension and compression. A similar formula might be valid for the relation between hardness and strain. Relations between true stress and true strain, and between Vickers hardness and true strain, are shown graphically.

3A-229. Some Experiences With the Creep Behaviour of Materials. A. Johansson. *Engineers' Digest*, v. 10, Oct. 1949, p. 340-342; discussion, p. 342-344. Translated and condensed from *Teknisk Tidskrift*, v. 79, Feb. 19, 1949, p. 127-132.

Service experience with high-temperature materials in steam turbines, gas turbines, and creep-testing machines.

3A-230. Die Spannungs-Dehnungskurve ferromagnetischer Werkstoffe (Magnetomechanische Hystereseschleife). [The Stress-Strain Curve of Ferromagnetic Materials (Magneto-Mechanical Hysteresis Curve).] Max Kornetzki. *Annalen der Physik*, ser. 6, v. 2, May 8, 1948, p. 265-269.

The relationship of torsion strength to torsion stress was determined for a soft nickel tube. Stress was applied cyclically, with stepwise increases in rate of application. Results show that relations between elongation and stress are exactly like those between magnetic induction and field strength. At very low amplitudes, variations of mechanical properties of ferromagnetic materials are parallel to those of the magnetic Rayleigh curve.

3A-231. Thickness of "Valence-Electron Atmospheres" and Electrode Potentials of Metals. (In Russian.) G. S. Koshurnikov. *Zhurnal Prikladnoi Khimii* (Journal of Applied Chemistry), v. 22, July 1949, p. 777-778.

Equation for relationship of the thickness of the layer of valence electrons to radius of metallic ions. Increase of standard electrode potentials of 18 metals with increase of thickness of this layer.

3A-232. Theory of Diagrams of Additive Deformation and Calculation of True Resistance to Rupture. (In Russian.) V. Ya. Shekhter. *Zavodskaya Laboratoriya* (Factory Laboratory), v. 15, Aug. 1949, p. 957-961.

Theoretically analyzes bases of the concept of additive deformation. Curves of additive deformation can be used for determination of true resistance to rupture. Typical determinations for a series of ferrous and nonferrous metals and alloys.

3A-233. Permeabilität und Wirbelströme in Blechkernen bei sehr hohen Frequenzen. (Permeability and Turbulent Currents in Sheet Cores at Very High Frequencies.) R. Feldtkeller. *Frequenz*, v. 3, Apr. 1949, p. 111-116.

Explains Wolman's theory of turbulent currents and shows mathematically that the course of complex initial permeability at low and high frequencies deviates in general from the initial permeability calculated for homogeneous sheet metal. The course of local initial permeability from surface to center of sheet is computed from the values of complex permeability.

3A-234. The Effect of Thermal-Mechanical History on the Strain Hardening of Metals. J. E. Dorn, A. Goldberg, and T. E. Tietz. *Transactions of the American Institute of Mining and Metallurgical Engineers*, v. 180, 1949, p. 205-224.

Previously abstracted from *Metals Technology*. See item 3a-118, 1948.

3A-235. Influence of Size and the Stress System on the Flow Stress and Fracture Stress of Metals. D. J. McAdam, Jr., G. W. Geil, D. H. Woodard, and W. D. Jenkins. *Transactions of the American Institute of Mining and Metallurgical Engineers*, v. 180, 1949, p. 363-381.

Previously abstracted from *Metals Technology*. See item 3a-62, 1948.

3A-236. Statistical Rate Theory of Metals. 1. Mechanism of Flow and Application to Tensile Properties. J. W. Fredrickson and H. Eyring. *Transactions of the American Institute of Mining and Metallurgical Engineers*, v. 180, 1949, p. 382-414.

Previously abstracted from *Metals Technology*. See item 3a-107, 1948.

3A-237. (Book) **Metallic Creep and Creep Resistant Alloys.** A. H. Sully. 278 pages. 1949. Interscience Publishers, New York.

Practical and theoretical aspects. Development of the existing theory of the strength of metals with special reference to creep, and certain metallurgical factors affecting creep. Experimental techniques and creep properties of ferrous and nonferrous alloys.

3A-238. (Book) **Permanent Magnets.** F. G. Spreadbury. Sir Isaac Pitman and Sons, Ltd., Parker St., Kingsway, London, W. C. 2, England. 35s. net.

Various magnetic materials in use in Britain. Places major emphasis on magnet design, although electromagnetism and magnetic theory are included where these subjects are relevant to permanent magnetism. Two final chapters are devoted to magnetization and demagnetization.

3A-239. (Book) **Problemy Ferromagnetizma i Magnetodinamiki.** (Problems of Ferromagnetism and Magnetodynamics.) V. K. Arkad'eva, editor. 175 pages. 1946. Section of Technical Sciences, Academy of Sciences of the U.S.S.R., Moscow and Leningrad.

Consists of 14 papers presented at a symposium held in Moscow in 1946, plus a series of diagrams for calculation of elastic and plastic permeability of plates and cylinders (p. 167-173). Papers are: "Magnetic Spectroscopy and Its Problems", V. K. Arkad'ev (p. 7-27); "Determination of Magnetic Permeability of Substances on the Basis of Their Effective Complex Magnetic Permeability by V. K. Arkad'ev's Method", K. M. Polivanov (p. 29-41); "Influence of Weiss Regions on the Relationship of Magnetic Permeability to Frequency", K. M. Polivanov (p. 43-54); "Investigation of Magnetic Properties of Iron Strips Used for Cable Shields', V. M. Goitannikov (p. 55-66); "Magnetic Spectra of Permalloy at Sonic Frequencies", A. I. Pil'shchikov (p. 67-72); "Determination of Magnetic Permeability of Ferromagnetic Conductors and Plates During Application of an Alternating Field", V. K. Arkad'ev and K. A. Volkova (p. 73-82); "Electrical Skin Effect in a Strip Having Complex Magnetic Permeability", V. K. Arkad'ev and A. A. Dobrovol'skaya (p. 83-87); "Reflection of Electrical Waves From a Hertz Grid, Parallel to the Magnetic Vector", O. I. Kozinets (p. 89-92); "Concerning Apparent Demagnetization", L. A. Yurovskii (p. 93-96); "Theory of Properties of Polycrystalline Ferromagnetics in Medium and Weak Magnetic Fields", E. I. Kondorskii (p. 97-127); "Limiting Demagnetization Factors in Cylinders", V. K. Arkad'ev (p. 129-132); "Derived Curves of Demagnetization According to Razumovskii for Different Materials", A. F. Matalin (p. 133-141); "Sensitivity of Residual Magnetization to External Fields", S. A. Khatyukov (p. 143-145); and "Distribution of Magnetic Flux in Rails During Their Magnetization by Means of the Rolling Electromagnet Used in Defect-Detection Instruments of the F. M. Karpov Type", K. M. Polivanov (p. 147-166).

3B—Ferrous

3B-228. Effect of Surface Roughness on Rolling Friction. J. J. Bikerman. *Journal of Applied Physics*, v. 20, Oct. 1949, p. 971-975.

Minimum tilt at which bearing balls roll down an inclined plate of stainless steel is greater for rough than for smooth surfaces. The roughest surfaces gave almost quantitative agreement between height of elevations and height of hills calculated from a theory attributing rolling friction to surface roughness. No similar agreement was observed for fine finishes. Elastic deformation of the surfaces in contact was irrelevant for coarse finishes. Capillary attraction presumably did not interfere, as superficial drying had no effect.

3B-229. Change of Electrical Resistance During the Strain Ageing of Iron. A. H. Cottrell and A. T. Churchman. *Journal of the Iron and Steel Institute*, v. 162, July 1949, p. 271-276.

It has been suggested that yield point and strain aging of α-iron are due to migration of C and N atoms to dislocations. One consequence of the theory is that electrical resistance should decrease by a small and roughly predictable amount on strain aging. This effect is shown to exist in soft-iron wire. Effect of increasing the temperature of aging and increasing the amount of cold work. 22 ref.

3B-230. The Diffuse Reflectivity of Oxide Layers Formed on Steels Under Defined Conditions. R. J. Donato. *Proceedings of the Physical Society*, v. 62, sec. B, Oct. 1, 1949, p. 629-638.

Method to determine reflectivity at various wavelengths in the visible spectrum and at different temperatures up to 660° C. Some results are given for the oxides of various steels. Application to theory and practice (pyrometry) is indicated. 11 ref.

3B-231. A Clinical Diagnosis on a Springmaker's Malady — Acid Brittleness. *Mainspring*, v. 13, Oct. 1949, unpaged.

Practical analysis of the problem and its solution. Acid brittleness of steel, otherwise known as hydrogen embrittlement, is usually created by absorption during pickling, and can be removed by one of many suitable combinations of time and temperature.

3B-232. Overvoltage of Hydrogen on Porous Iron. (In Russian.) L. L. Kuz'min and V. S. Poroikova. *Zhurnal Prikladnoi Khimii* (Journal of Applied Chemistry), v. 22, June 1949, p. 572-577.

The reduction of hydrogen overvoltage on electrodes with built-up surfaces of porous iron obtained by powder metallurgy was investigated. Influence of conditions of electrode production on potential. At high current densities, hydrogen overvoltage is approximately 0.3 volt less than on smooth iron.

3B-233. Strength of Carbon Steels at High Temperatures. (In Russian.) M. A. Zaikov. *Zhurnal Tekhnicheskoi Fiziki* (Journal of Technical Physics), v. 19, June 1949, p. 684-695.

Relationship of yield strength to temperature of annealing and melting point by experiments on fracture of test specimens of carbon steels containing 0.12-1.19% C. Formulas for computation of mechanical constants. Experimental method. Results for structural toolsteels for different temperature regions (20-1300° C.). 26 ref.

3B-234. Influence of Rate of Deformation on Strength of Carbon Steel at High Temperatures. (In Russian.) M. A. Zaikov. *Zhurnal Tekhnicheskoi Fiziki* (Journal of Technical Physics), v. 19, June 1949, p. 711-721.

Experiments on fracture of steel (0.08-0.15% C) at different rates of deformation and different temperatures (20-1150° C.) establish relationship of yield strength and constant of plastic deformation to temperature and rate of deformation. Agreement of rate coefficient with previously determined relationship of yield strength to temperature and chemical composition of steel is indicated. 30 ref.

3B-235. Viscosity of Molten Iron-Carbon Alloys. (In Russian.) A. M. Samarin and L. A. Shvartsman. *Izvestiya Akademii Nauk SSSR, Otdelenie Tekhnicheskikh Nauk* (Bulletin of the Academy of Sciences of the USSR, Section of Technical Sciences), June 1949, p. 891-899.

Relationship to composition and temperature was investigated. Viscosity of molten iron may be predicted approximately by the theory of transition states. Applicability of formulas of Bachenskii for composition and temperature dependence of viscosity.

3B-236. Comparative Creep Characteristics of Type 14-14 Chromium-Nickel and Chromium-Manganese Steel. (In Russian.) A. M. Borzdyka. *Izvestiya Akademii Nauk SSSR, Otdelenie Tekhnicheskikh Nauk* (Bulletin of the Academy of Sciences of the USSR, Section of Technical Sciences), June 1949, p. 900-906.

Investigated on four samples of Type 14-14 steel with 2.5% W, two being Cr-Ni base and two Cr-Mn base. Each pair included a low-carbon and a medium-carbon steel. The Cr-Mn austenite was found to have much higher (10-20%) thermal stability than the Cr-Ni. Thermal stability of Cr-Mn steel of the austenite-ferrite type is shown to be directly dependent on relative content of alpha and gamma phases.

3B-237. Concerning the Properties of Hot-Quenched High Speed Steels. (In Japanese.) Masazo Okamoto and Miturn Nagakura. *Nippon Kinzoku Gakkai-Si* (Journal of the Japan Institute of Metals), v. 13, Apr. 1949, p. 31-34.

The above were investigated with respect to hardness, specific gravity, microstructure, thermal expansion, and specific resistance.

3B-238. Research on Austenitic Stainless Steel of the Ni-Cr-Mn System. (In Japanese.) Yoshitaro Fuke. *Nippon Kinzoku Gakkai-Si* (Journal of the Japan Institute of Metals), v. 13, Apr. 1949, p. 34-37.

Purpose of investigation was to obtain alloys equal to 18-8 stainless in metallurgical properties, especially corrosion resistance, by addition of a fourth element. The elements Ti, Mo, V, Si, and Al were chosen for investigation. On this basis, 20 alloys were prepared and their mechanical properties and corrosion resistance determined. Results show superiority over 18-8 in two or three cases.

3B-239. How Chromium Plating Affects Fatigue Life of Aircraft Steels. *Steel*, v. 125, Nov. 7, 1949, p. 110-111, 142. A condensation.

Previously abstracted from *Journal of Research of the National Bureau of Standards*. See item 3B-219, 1949.

3B-240. La-Led: A New, Free-Machining Bar Steel. Glenn D. Boyer. *Screw Machine Engineering*, v. 11, Nov. 1949, p. 38-40.

A cold finished openhearth steel containing lead and 0.08-0.13% C is said to realize large savings on a variety of screw-machine parts by replacing bessemer and resulfurized openhearth steels.

3B-241. Growth of Cast Iron. W. C. Blott. *Iron Age*, v. 164, Nov. 10, 1949, p. 88-91.

Growth characteristics of a series of high-strength cast irons used for parts which may be subjected to elevated temperatures. Effects of various alloying additions.

3B-242. Production Data Sheet. *Production Engineering & Management*, v. 24, Nov. 1949, p. 65.

General engineering types of steel castings classified according to tensile strengths. Includes specifications.

3B-243. Low Temperature Fatigue Tests on Steel. Hempel. *Product Engineering*, v. 20, Nov. 1949, p. 125-127. Condensed from *Wright-Patterson Air-Force Base, Headquarters Air Matériel Command*, Translation F-TS-1855-RE. Translated from *Kaiser Wilhelm-Institut für Eisenforschung*, ZWB Report FB 1704/1, Dec. 18, 1942.

Results of tensile, fatigue, notched-bar impact, endurance limit, and hardness tests on a series of 14 aircraft structural steels.

3B-244. Influence of Transition from Static to Dynamic Tensile Stress on Character of Plastic Deformation of Steel. (In Russian.) B. A. Krupitskii. *Zavodskaya Laboratoriya* (Factory Laboratory), v. 15, July 1949, p. 831-834.

Character of distribution of plastic deformation among individual zones in the test specimen and the influence of transition from static to dynamic tensile stress on plastic deformation in these zones. Cr-Mo structural steel with different heat treatments was investigated as an example.

3B-245. Concerning the Dynamic Characteristics of the Magnetostrictive Alloy "Alfer". (In Japanese.) Hakaru Masumoto and Goro Otomo. *Nippon Kinzoku Gakkai-Si* (Journal of the Japan Institute of Metals), v. 13, Jan. 1949, p. 1-4.

Dynamic characteristics of Fe-Al alloys containing 6.36-14.38% Al were measured in fields of 5, 10, 15, and 20 oersteds. The two curves representing the relationships of magnetostrictive activity and sound velocity to concentration in a field of 10 oersteds have maxima and minima, respectively, in the range 12.2-13.4% Al. A small addition of Ni greatly increases magnetostrictive properties. Electro-acoustic efficiencies are of the same order as Ni—nearly 100%.

3B-246. Temper Brittleness of Si-Mn-Cr Steels. III. Effect of Manganese. IV. The Effect of Chromium. (In Japanese.) S. Koshiba and K. Nobara. *Nippon Kinzoku Gakkai-Si* (Journal of the Japan Institute of Metals), v. 13, Jan. 1949, p. 30-36.

Effects of 0.6-1.2% Mn and Cr were investigated and found to increase rapidly with Mn content. Maximum temper brittleness occurs at a tempering temperature of 600-650° C. For Cr, "first temper brittleness" was observed at over 0.80% Cr, and "second temper brittleness" increases rapidly with Cr content. For 0.8-1.2% Cr, temper brittleness is very large at a tempering temperature of 600° C.

3B-247. Concerning Grain Growth and Cutting Durability of High-Speed Steel. (In Japanese.) S. Koshiba. *Nippon Kinzoku Gakkai-Si* (Journal of the Japan Institute of Metals), v. 13, Jan. 1949, p. 36-40.

In high speed steel, grain growth is generally caused by "high" quenching temperature, value of the latter varying with heat treatment prior to quenching. Usually steel of smaller grain size is superior in cutting durability, but heat treating history must also be considered.

3B-248. Über die Temperaturabhängigkeit der Permeabilität und der Nachwirkung ferromagnetischer Werkstoffe. (The Temperature Dependence of Permeability and of After-Effect of Ferromagnetic Materials.) Hermann Fahlenbrach. *Annalen der Physik*, ser. 6, v. 2, June 15, 1948, p. 355-369.

Permeability vs. field strength and magnetic after-effects were measured for commercially "pure irons", and for Fe-Si, Fe-Ni, and Fe-Cr-Al alloys from 200° C. to the respective Curie points. A series of anomalous temperature ranges of permeability in which magnetic switch-off after-effects are found support Snoek's theory. With some exceptions, permeability values greatly increase with temperature up to near the Curie point. 11 ref.

3B-249. Influence of Cold Hardening by Application of Tensile Stress on Notch Plasticity During Bending. (In Russian.) P. O. Pashkov and M. D. Chernyshava. *Zhurnal Tekhnicheskoi Fiziki* (Journal of Technical Physics), v. 19, July 1949, p. 782-791.

The problem was investigated for 0.18% C steel. Results fully confirmed the theoretical explanation. The results could not satisfactorily be applied to other types of cold hardening, such as those induced by compression and torsion.

3B-250. Notch-Tensile Characteristics of a Partially Austempered, Low Alloy Steel. G. Sachs, L. J. Ebert, and W. F. Brown, Jr. *Transactions of the American Institute of Mining and Metallurgical Engineers*, v. 176, 1948, p. 424-435.

Previously abstracted from *Metals Technology*. See item 3b-25, 1948.

3B-251. Influence of Strain Aging on the Fracture Stress of Low-Carbon Steel. D. J. McAdam, Jr., G. W. Geil, D. H. Woodard, and W. D. Jenkins. *Transactions of the American Institute of Mining and Metallurgical Engineers*, v. 176, 1948, p. 436-446; discussion, p. 447.

Previously abstracted from *Metals Technology*. See item 3b-17, 1948.

3B-252. Anelastic Properties of Iron. T'ing-sui Ke. *Transactions of the American Institute of Mining and Metallurgical Engineers*, v. 176, 1948, p. 448-474; discussion, p. 474-476.

Previously abstracted from *Metals Technology*. See item 3b-92, 1948.

3B-253. Wear Tests on Grinding Balls. T. E. Norman and C. M. Loeb, Jr. *Transactions of the American Institute of Mining and Metallurgical Engineers*, v. 176, 1948, p. 490-520; discussion, p. 520-526.

Previously abstracted from *Metals Technology*. See item 3b-58, 1948.

3B-254. Behavior of Metal Cavity Liners in Shaped Explosive Charges. G. B. Clark and W. H. Bruckner. *Transactions of the American Institute of Mining and Metallurgical Engineers*, v. 176, 1948, p. 527-538; discussion, p. 538-540.

Previously abstracted from *Metals Technology*. See item 3-168, 1947.

3B-255. Plastic Flow in Anisotropic Sheet Steel. L. R. Jackson, K. F. Smith, and W. T. Lankford. *Transactions of the American Institute of Mining and Metallurgical Engineers*, v. 180, 1949, p. 415-429.

Previously abstracted from *Metals Technology*. See item 3b-142, 1948.

3B-256. Stabilization of the Austenite-Martensite Transformation. W. J. Harris, Jr., and M. Cohen. *Transactions of the American Institute of Mining and Metallurgical Engineers*, v. 180, 1949, p. 447-470.

Previously abstracted from *Metals Technology*. See item 4b-84, 1948.

3B-257. The Magnetic Properties of Sintered Iron and Iron Base Alloys. W. Rostoker. *Tranеactions of the American Institute of Mining and Metallurgical Engineers*, v. 180, 1949, p. 672-693.

Previously abstracted from *Metals Technology*. See item 3b-187, 1948.

3B-258. (Book) **Zheleznye Splavy. Tom I. Splavy Zhelezo-Khrom-Alyuminii.** (Ferrous Alloys. Vol. I. Iron-Chromium-Aluminum Alloys.) I. I. Kornilov. 192 pages. 1945. Laboratory of Ferrous Alloys, Institute of General and Inorganic Chemistry, Academy of Sciences of the U.S.S.R., Moscow and Leningrad.

First volume of series of monographs. Physical and mechanical properties of different compositions in the Fe-Cr-Al system, and in the included binary systems; also the influences of fourth components. Modern production methods, including the aluminothermic process. Applications. 210 ref.

3C—Nonferrous

3C-208. Elimination by Lithium of Bismuth Embrittlement in Coppers. W. A. Baker and A. P. C. Hallowes. *Engineering*, v. 168, Oct. 7, 1949, p. 379-380. **Condensed from "The Elimination by Lithium of Bismuth Embrittlement in Deoxidized Coppers and Copper Alloys".**

Previously abstracted from *Journal of the Institute of Metals*. See item 3C-128, 1949.

3C-209. Metallography and Mechanical Properties of Internally Oxidized Alloys. *Research*, v. 2, Oct. 1949, p. 492-493.

Confirms and extends work of Meijering and Druyvesteyn, who showed that internal oxidation on annealing of certain dilute Ag and Cu-base alloys sometimes results in appreciable hardening. A Cu alloy containing 0.6% Al forms a single internally oxidized rim which is appreciably harder than the original alloy. By varying the annealing treatment it is possible to produce a rim which consists of two distinct zones.

3C-210. New Age-Hardening Alloy Meets Many Engineering Specifications. *Steel*, v. 125, Oct. 31, 1949, p. 46-49, 74.

Recommended techniques for forging, machining, and welding International Nickel's new high-temperature alloy designated as "Inconel X". Adaptability for such parts as gas-turbine rotor wheels, blades, and vanes, and for jet-engine and rocket-motor components.

3C-211. High Frequency Surface Resistivity of Tin in the Normal and Superconducting States. William M. Fairbank. *Physical Review*, ser. 2, v. 76, Oct. 15, 1949, p. 1106-1111.

Measurements were made at 9400 megacycles per sec. of the unloaded Q of a tin cavity from 74.9 down to 1.26° K. From these values and a knowledge of the geometry of the cavity, the high-frequency surface resistivity of white tin was calculated as a function of temperature in both the normal and the superconducting states. 18 ref.

3C-212. Nuclear Magnetic Resonance Shift in Metals. W. D. Knight. *Physical Review*, ser. 2, v. 76, Oct. 15, 1949, p. 1259-1260.

Observation of shift from expected values in Li, Na, Al, Cu, and Ga, in magnetic fields of 5-10,000 gausses, using an automatic search-type radiofrequency spectrometer.

3C-213. A Thermodynamic Study of Liquid Metallic Solutions. I. The System Lead-Gold. O. J. Kleppa. *Journal of the American Chemical Society*, v. 71, Oct. 1949, p. 3275-3280.

Chemical potentials and partial molar entropies of mixing for Pb in liquid Pb-Au mixtures were determined by the emf. method for compositions up to 79 atomic % Au. From these data, activities at 600° C., "entropy fractions", and relative partial and integral molar heats of mixing were calculated. Heat and free energies of formation for $Au_2Pb(s)$ from liquid-Pb and undercooled liquid Au at about 400° were also calculated.

3C-214. Anisotropic Permanent Magnet Alloys. K. Hoselitz and M. McCaig. *Nature*, v. 164, Oct. 1, 1949, p. 581-582.

Results of measurements of some magnetic characteristics of "Alcomax" and compares them with those of Jellinghaus on another anisotropic permanent magnet alloy. Results confirm some of the conclusions of Jellinghaus and give information about the origin of the remarkable magnetic hardness of this type of alloy.

3C-215. The Basis of the Electron Theory of Metals, With Special Reference to the Transition Metals. N. F. Mott. *Proceedings of the Physical Society*, v. 62, sec. A, July 1, 1949, p. 416-422.

The collective electron and London-Heitler models are not to be regarded as different approximations to the same exact wave function for solids in which, according to the former model, there is a partially filled zone of energy levels. Thus shows why nickel oxide in the pure state is a nonconductor, although it contains an incomplete zone. Properties of Ni, Pd, and Pt in the light of the results. 21 ref.

3C-216. The Effect of Instantaneous Pre-Strain on the Character of Creep in Lead Polycrystals. A. J. Kennedy. *Proceedings of the Physical Society*, v. 62, sec. B, Aug. 1, 1949, p. 501-508.

Shows how extension vs. time curves of lead wires subjected to rapid strain just before the experiment may be expressed by the Andrade creep equation, using the same constants as those which satisfy the creep of the metal under the same constant stress, but with the t value associated with β replaced by $(t+t_0)$, where t_0 is a constant for a given experiment, its value increasing with increasing pre-strain.

3C-217. A Study of Magnetic Viscosity. R. Street and J. C. Woolley. *Proceedings of the Physical Society*, v. 62, sec. A, Sept. 1, 1949, p. 562-572.

A general analysis of magnetic viscosity based on activation-energy concepts. Considers particular case of application of the theory to phenomena occurring in materials in which bulk magnetization proceeds by rotational movements of vectors of single domains. Experiments were made using a magnetometer method, with specimens of Alnico maintained at various temperatures from −187 to 250° C. 10 ref.

3C-218. The Optical Constants of Thin Metallic Films. R. Weale. *Proceedings of the Physical Society*, v. 62, sec. B, Sept. 1, 1949, p. 576-578.

The above are shown to depend on thickness of the films due to variation of electrical conductivity with thickness. Good and bad conductors both exhibit maxima in the curves relating absorption coefficient and film thickness, but these peaks are due to entirely different causes. Results for Pt, Pd, Au, Ag, and Cu. 10 ref.

3C-219. Propriétés d'aimant des poudres ferromagnétiques. Cas particulier de l'alliage MnBi. (Magnetic Properties of Ferromagnetic Powders. The Particular Case of MnBi Alloys.) Charles Guillaud. *Journal des recherches du Centre National de la Recherche Scientifique*, no. 9, 1949, p. 267-278.

Relationship of coercive field to size of powder particles, and influence of temperature and orientation on residual magnetism and coercive field.

3C-220. Britische Kupfersorten und -legierungen. (British Types of Copper and Copper Alloys.) H. Bröking. *Metall*, v. 3, Aug. 1949, p. 254-256.

Tabulated discussion on compositions and properties.

3C-221. Die heterogene Ausscheidung im System Gold-Nickel. (Heterogeneous Precipitation in the Gold-Nickel System.) Walther Gerlach. *Zeitschrift für Metallkunde*, v. 40, Aug. 1949, p. 281-289.

Magnetic and electrical properties as well as precipitation behavior of four supersaturated Au-Ni solid solutions (50, 23, 10, and 5% Ni) were quantitatively investigated by determining magnetic properties at different temperatures. Method of experimentation and results. 13 ref.

3C-222. Katalytische Untersuchungen an Legierungen. XII. Die Parawasserstoff-Umwandlung an Kupfer-Platin-Mischkristallen. (Catalytic Studies on Alloys. XII. The Parahydrogen Transformation in Copper-Platinum Solid Solutions.) Günther Rienäcker and Brigitte Sarry. *Zeitschrift für anor-*

ganische Chemie, v. 257, Aug. 1948, p. 41-58.

Attempts to prove and explain the catalytic effect of metals and alloys —using Pt and its solid solutions with Cu as an example—by use of parahydrogen. Experimental production of the latter and method for determining the degree of transformation. Experimental apparatus. 14 ref.

3C-223. Thermoelectric Properties of Monovalent Metals. (In Russian.) F. G. Serova. *Zhurnal Eksperimental 'noi i Teoreticheskoi Fiziki* (Journal of Experimental and Theoretical Physics), v. 19, May 1949, p. 460-468.

Thompson coefficient is calculated at high temperatures for Li and Na, taking into consideration the effect of entrainment of electrons by a stream of photons and the principle of partial dependence of length of free path of electrons on energy other than that of free electrons. 10 ref.

3C-224. Magnetic Anisotropy of Binary Nickel-Base Alloys. (In Russian.) I. M. Puzei. *Zhurnal Tekhnicheskoi Fiziki* (Journal of Technical Physics), v. 19, June 1949, p. 653-660.

The law of approach to saturation was investigated for polycrystals of Ni-Cu and Ni-Mo alloys. Relationships of anisotropic constant to temperature, concentration, and type of addition were determined. 15 ref.

3C-225. Influence of Tensile Stress on Spontaneous Magnetization of Nickel Close to the Curie Point. (In Russian.) K. P. Belov. *Zhurnal Tekhnicheskoi Fiziki* (Journal of Technical Physics), v. 19, June 1949, p. 661-666.

Shows experimentally that elastic tensile stress influences the value of spontaneous magnetization of nickel and is especially significant in the region of the Curie point. This effect corresponds to the anomalous thermal expansion of nickel at the Curie Point. 13 ref.

3C-226. Influence of Surface-Active Substances on Small Deformations of Tin Monocrystals. (In Russian.) V. I. Likhtman and E. P. Zakoshchikova. *Doklady Akademii Nauk SSSR* (Reports of the Academy of Sciences of the USSR), new ser., v. 66, June 1, 1949, p. 657-660.

Investigated for the range of stresses up to the yield point on tin wire 1 mm. in diam., and 2-3 cm. long. Comparative data for deformation in air and in surface-active media. Relaxation of elastic stresses in crystals in the presence of surface-active substances is more complete, and the value of remaining non-relaxing elastic stresses is considerably less than in nonactive media.

3C-227. Concerning the Vapor Pressure of Some Pure Metals. (In Japanese.) Kideo Kaneko. *Nippon Kinzoku Gakkai-Si* (Journal of the Japan Institute of Metals), v. 13, Apr. 1949, p. 24-27.

The vapor pressures of Cd, Mg, Se, Te, and Zn were measured by the boiling-point method devised by the author. From the results, empirical formulas for the relation between vapor pressure and temperature were determined.

3C-228. Research on Selenium and Its Alloys. III. Vapor Pressure of Selenium Alloys. (In Japanese.) Tomo-o Sato and Kideo Kaneko. *Nippon Kinzoku Gakkai-Si* (Journal of the Japan Institute of Metals), v. 13, Apr. 1949, p. 27-31.

On the basis of data obtained from the refining of crude Se by distillation, results for binary alloys with Sn, Bi, Te, Hg, S, Cd, and Zn were obtained.

3C-229. Mechanisms of Failure of High Nickel-Alloy Turbojet Combustion Liners. John W. Weeton. *National Advisory Committee for Aeronautics*, Technical Note 1938, Oct. 1949, 45 pages.

Studies were made of "as-fabricated", heat treated, and mechanically finished liners, on liners after service operation, and on liners after accelerated engine runs. Large numbers of cracks formed at stress-relieving holes of louvers. Surface and subsurface scale was extensive. Resistance to cracking was increased by removing stress raisers from stress-relieving holes.

3C-230. Evaluation of the Stiffness Coefficients for Beryllium From Ultrasonic Measurements in Polycrystalline and Single Crystal Specimens. Louis Gold. *U. S. Atomic Energy Commission*, AECD 2644, July 21, 1949, 25 pages.

Experimental procedure. 11 ref.

3C-231. Some Properties of Superconductors Below 1° K. II. Aluminum and Zinc. J. G. Daunt and C. V. Heer. *Physical Review*, ser. 2, v. 76, Nov. 1, 1949, p. 1324-1328.

Magnetic measurements of the threshold curves of superconducting Al and Zn of very high purity were carried out down to 0.3° K. Calculations were made of the entropy differences between the normal and superconducting states and of the specific heats of the electron assemblies in both states. 26 ref.

3C-232. Surface Impedance of Normal and Superconductors at 24,000 Megacycles Per Second. E. Maxwell, P. M. Marcus, and J. C. Slater. *Physical Review*, ser. 2, v. 76, Nov. 1, 1949, p. 1332-1347.

Surface impedance of tin at 24,000 mc. per sec. was investigated from 2 to 300° K., including both the superconducting and normal states, by means of a resonant-cavity technique. Experimental techniques; data for the normal state discussed in terms of the theory of anomalous skin effect given by Reuter and Sondheimer. 13 ref.

3C-233. Ueber die Entfestigung von Legierungen. (Concerning the Stress-Relief of Alloys.) E. Brandenberger. *Schweizer Archiv für angewandte Wissenschaft und Technik*, v. 15, Sept. 1949, p. 258-259.

Observations that filing chips undergo spontaneous stress relief even at room temperature led to experimentation on the differential behavior of crystal aggregates and pulverized materials with respect to stress-relief annealing at different temperatures. Experiments were made with three high-gold alloys, with pure Ni, and with three high-Ni alloys.

3C-234. The Relationship Between Energy Levels of the Valence Electrons of Cu and Its Photoelectric Effects and Light Absorption of a Thin Film. (In Japanese.) Mituru Sato and Tosiro Suzoka. *Nippon Kinzoku Gakkai-Si* (Journal of the Japan Institute of Metals), v. 13, Jan. 1949, p. 9-12.

Relative positions of energy levels determined from X-ray spectra were reported in a previous paper. These results are compared with those based on photoelectric effects and light absorption. Certain fundamental conclusions regarding the mechanism of electrical conduction and photoelectric emission are summarized in English.

3C-235. Zur Temperaturabhängigkeit der Magnetisierung von Nickel. (The Temperature Dependence of the Magnetization of Nickel.) W. Jellinghaus and H. Schlechtweg. *Annalen der Physik*, ser. 6, v. 2, Apr. 1, 1948, p. 161-177.

A study made to test the validity of Weiss's law. Langevin's theory is explained and numerous mathematical equations develop a differentiation of the equilibrium equation and a way of determining the magnetization constant, Weiss's factor, and effect of magnetization constant and temperature on field strength.

3C-236. Über einen neuen Nachweis von spontaner Magnetisierung oberhalb der Curietemperatur. (A New Proof of Spontaneous Magnetization Above the Curie Temperature.) Friedrich Fraunberger. *Annalen der Physik*, ser. 6, v. 2, Apr. 1, 1948, p. 178-182.

Observations of high-frequency permeability of nickel showed that it, and also spontaneous magnetization, disappears only at 50-100° C. above the Curie point. Methods of measurement and results.

3C-237. Die Eisen-Platin-Invare und ihre Ausdehnungs-Anomalien. (The Iron-Platinum Invars and Their Expansion Anomalies.) A. Kussmann, M. Auwärter, and G. Grfn v. Rittberg. *Annalen der Physik*, ser. 6, v. 4, Nov. 24, 1948, p. 174-182.

Pt-Fe alloys between 54 and 65 weight % show stronger Invar effects than nickel steels, and negative thermal coefficients of expansion are the largest observed so far. Properties can be controlled by heat treating, their change being related to the formation or solution and ordered dispersion of Fe_3Pt atoms. Observed phenomena are explained by the extremely high magnetostriction of the alloys up to 300° C.

3C-238. Zur magnetischen Suszeptibilitat von in flüssigem Ammoniak gelösten Metallen. (Concerning the Magnetic Susceptibility of Metals Dissolved in Liquid Ammonia.) Erich Huster. *Annalen der Physik*, ser. 6, v. 4, Nov. 24, 1948, p. 183-190.

Determination for calcium. Results are compared with those obtained by other authors for Na, Cs, K, Ca, and Ba. Apparatus and technique; results.

3C-239. A High Strength-High Conductivity Copper-Silver Alloy Wire. W. Hodge, R. I. Jaffee, J. G. Dunleavy, and H. R. Ogden. *Transactions of the American Institute of Mining and Metallurgical Engineers*, v. 180, 1949, p. 15-31.

Previously abstracted from *Metals Technology*. See item 3c-50, 1948.

3C-240. A Copper-Base Alloy Containing Iron as a High-Strength High-Conductivity Wire Material. W. Hodge, R. I. Jaffee, J. G. Dunleavy, and H. R. Ogden. *Transactions of the American Institute of Mining and Metallurgical Engineers*, v. 180, 1949, p. 32-41.

Previously abstracted from *Metals Technology*. See item 3c-72, 1948.

3C-241. Effect of Grain Size on Tensile Strength, Elongation, and Endurance Limit of Deep Drawing Brass. H. L. Walker and W. J. Craig. *Transactions of the American Institute of Mining and Metallurgical Engineers*, v. 180, 1949, p. 42-51.

Previously abstracted from *Metals Technology*. See item 3c-88, 1948.

3C-242. Electrical Properties of the Intermetallic Compounds Mg_2Sn and Mg_2Pb. W. D. Robertson and H. H. Uhlig. *Transactions of the American Institute of Mining and Metallurgical Engineers*, v. 180, 1949, p. 345-355.

Previously abstracted from *Metals Technology*. See item 3c-108, 1948.

3C-243. The Low Temperature Properties of Tin and Tin-Lead Alloys. H. S. Kalish and F. J. Dunkerley. *Transactions of the American Institute of Mining and Metallurgical Engineers*, v. 180, 1949, p. 637-656.

Previously abstracted from *Metals Technology*. See item 3c-86, 1948.

3C-244. Thermal and Electrical Properties of Ductile Titanium. E. S. Greiner and W. C. Ellis. *Transactions of the American Institute of Mining and Metallurgical Engineers*, v. 180, 1949, p. 657-665.

Previously abstracted from *Metals Technology*. See item 3c-87, 1948.

3C-245. (Book) Blagorodnye Metally. Svoistva, Primenenie, Zameniteli. (Precious Metals. Properties, Applications, Substitutes.) A. V. Boitsov, G. F. Boitsova, and N. A. Avdonina. 387 pages. 1946. State Scientific-Technical Publishing House for Literature on Ferrous and Nonferrous Metallurgy, Moscow, U.S.S.R.

A comprehensive handbook on the physical and chemical properties of precious metals and their alloys and their application in industry and research. The first part covers gold and its alloys; the second, silver and its alloys; and the third the platinum group (platinum, ruthenium, rhodium, palladium, osmium, and iridium). 116 ref.

3D—Light Metals

3D-73. Beitrag zur Kreuzschweissprüfung von Leichtmetallblechen geringer Dicken. (Transverse Weld Testing of Thin Sheets of Light Metal.) Friedrich Erdmann-Jesnitzer. *Zeitschrift für Metallkunde*, v. 39, Dec. 1948, p. 385-390.

The tendency of seven different Al-Mg alloys (1-3 mm. thick) to weld cracking. Welding properties vary considerably with thickness and composition. Behaviors were compared with those of sheet steel. 12 ref.

3D-74. Transmission and Reflection Coefficients of Aluminium Films for Interferometry. M. F. Crawford, W. M. Gray, A. L. Schawlow, and F. M. Kelly. *Journal of the Optical Society of America*, v. 39, Oct. 1949, p. 888.

The films were deposited by evaporation in vacuum, using both low and high rates. Results are measured.

3D-75. Ueber Standard-Aluminiumgusslegierungen. (Concerning Standard Aluminum Cast Alloys.) August Buckeley. *Die neue Giesserei*, v. 36 (new ser., v. 2), Sept. 1949, p. 269-273.

The term "standard alloys" is defined. Compositions, properties, melting and casting methods for six different alloys, compared with the physical and machining properties of cast iron. 12 ref.

3D-76. Factors Affecting the Tensile Notch Sensitivity of Magnesium Alloy Extrusions. I. Cornet. *Transactions of the American Institute of Mining and Metallurgical Engineers*, v. 180, 1949, p. 322-344.

Previously abstracted from *Metals Technology*. See item 3d-54, 1948.

3D-77. Absorption of Gamma-Rays in Aluminum. W. C. Parkinson. *Physical Review*, ser. 2, v. 76, Nov. 1, 1949, p. 1348-1352.

Scattering cross section for gamma-rays in Al was measured by two independent methods at three energies. Results are in agreement with predictions of theory within experimental error of $\pm 1\%$. 25 ref.

3D-78. Effect of Open Circular Holes on Tensile Strength and Elongation of Sheet Specimens of Some Aluminum Alloys. H. N. Hill and R. S. Barker. *National Advisory Committee for Aeronautics*, Technical Note 1974, Oct. 1949, 40 pages.

Tests were made on 24S-T3, 24S-T81, 24S-T86, 24S-O, Alclad 75S-T6, Alclad 14S-T6, and Alclad 14S-T3 Al-alloy sheet specimens having a ratio of hole diameter to thickness of sheet of 3.

3D-79. Some Preliminary Information of Buckling and Ultimate Strength of Unstiffened Compression Skin Obtained Through Bending and Compression Tests on Rectangular Cross Section Aluminum Tubes. Roger A. Anderson. *Aeronautical Research Institute of Sweden* (Stockholm), Report No. 27, 1949, 25 pages.

A comparison between theoretical and experimental buckling and maximum stresses developed in pure compression and in compression due to bending.

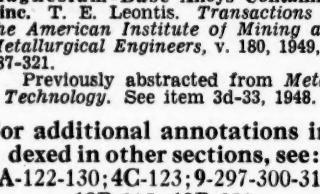
3D-80. The Flow and Fracture Characteristics of the Aluminum Alloy 24S-T After Alternating Tension and Compression. S. I. Liu and G. Sachs. *Transactions of the American Institute of Mining and Metallurgical Engineers*, v. 180, 1949, p. 193-204.

Previously abstracted from *Metals Technology*. See item 3d-34, 1948.

3D-81. The Room and Elevated Temperature Properties of Some Sand Cast Magnesium-Base Alloys Containing Zinc. T. E. Leontis. *Transactions of the American Institute of Mining and Metallurgical Engineers*, v. 180, 1949, p. 287-321.

Previously abstracted from *Metals Technology*. See item 3d-33, 1948.

For additional annotations indexed in other sections, see:
4A-122-130; 4C-123; 9-297-300-316; 18B-205; 19B-220



4 CONSTITUTION and STRUCTURE

4A—General

4A-118. Theory of Growth of Spherical Precipitates From Solid Solutions. Clarence Zener. *Journal of Applied Physics*, v. 20, Oct. 1949, p. 950-953.

Radius of a spherical precipitate particle growing in a solid solution of initially uniform composition has been shown to be equal to the square root of atomic diffusion coefficient times time, multiplied by a growth coefficient. The precise relationship of this function to pertinent compositions. A similar computation for the coefficient corresponding to one-dimensional growth of a plate.

4A-119. Interstitial Atomic Diffusion Coefficients. C. Wert and C. Zener. *Physical Review*, ser. 2, v. 76, Oct. 15, 1949, p. 1169-1175.

Attempts to interpret the temperature-independent factor D_0 of the previously determined diffusion coefficients of interstitial solute atoms in metals. All past observations except for C and N in α-Fe are consistent with a theoretical range of entropy factors. D_0's for these systems were, therefore, redetermined by more precise measurements, and are found to be higher than the original values. Associated entropy factors are consistent with the theoretical range. 11 ref.

4A-120. The Mechanism of Dilatancy. E. N. da C. Andrade and J. W. Fox. *Proceedings of the Physical Society*, v. 62, sec. B, Aug. 1, 1949, p. 483-500.

The dilatancy in question is the change of over-all volume produced by strain in an assembly of particles. This was demonstrated for a mixture of sand and water by a photoelectric method of measuring wetness of the surface. The general phenomenon was studied in detail with a two-dimensional hexagonal array of uniform cylinders, part of the free surface of which is loaded with a rigid piston. Elastic stress distribution before slipping takes place was calculated and shown to be a determining factor. Effect of friction between the component units. Experiments were also carried out on three dimensional irregular arrays of carbon shot and of sand.

4A-121. Boundary Migration and Grain Growth. Walter C. McCrone. *Discussions of the Faraday Society*, No. 5 (Crystal Growth), 1949, p. 158-166.

Two types of "boundary migration", which is used as a synonym for grain growth. The two types are known as the DDT Type, in which orientation controls the direction of boundary migration; and the octachloropropane type, in which orientation has little or no effect. Additional work was done on comparison of the rate of growth of octachloropropane at different temperatures with corresponding data for metals systems.

4A-122. Reviews of Certain Aspects of Metal Physics. Part I. X-Ray Work in Some Fields of Research on Metals and Alloys, 1939 to 1946. Audrey M. B. Douglas. **Part II. Thermal Conductivities of Molten Metals and Alloys.** R. W. Powell. *Journal of the Iron and Steel Institute*, v. 162, July 1949, p. 299-324.

270 references.

4A-123. Constitution of Iron-Nickel-Chromium Alloys at 650° to 800° C. W. P. Rees, B. D. Burns, and A. J. Cook. *Journal of the Iron and Steel Institute*, v. 162, July 1949, p. 325-336.

A considerable number of the alloys were prepared containing 40-80% Fe, 0-60% Ni, and 0-50% Cr, using component elements of very high purity. Metallographic and X-ray investigations of alloy structures were made to determine limits of composition at which the sigma constituent did not exist as an equilibrium component after annealing at 650 and 800° C. These limits extend to considerably lower Cr contents than previously stated. Transition from the γ phase to the $(\gamma+\sigma)$ phase was not always a single-stage reaction, but could be preceded by precipitation of an intermediate phase.

4A-124. Further X-Ray Study of the Equilibrium Diagram of the Iron-Nickel System. E. A. Owen and Y. H. Liu. *Journal of the Iron and Steel Institute*, v. 163, Oct. 1949, p. 132-137.

The materials were investigated in powder and in lump form, at room and at elevated temperatures. Effects of contamination and insufficient annealing of the specimens, and of sensitivity of the X-ray method were investigated. The diagram recorded previously by Owen and Sully is largely confirmed.

4A-125. Über das Verhalten von FeS zu den Kobaltsulfiden Co_9S_8 und Co_3S_4. (The Behavior of FeS Toward the Cobalt Sulfides Co_9S_8 and Co_3S_4.) Rudolf Vogel and Ruth Au. *Zeitschrift für Metallkunde*, v. 40, Aug. 1949, p. 290-295.

Phase relationships and solubilities were studied by X-ray and metallographic methods. Lattice parameters are calculated. Includes constitution diagrams.

4A-126. Macromolecular and Micellar Structure of Metals. XI. Colloidal Phenomena in Metals. (In Russian.) Yu. A. Klyachko. *Zhurnal Prikladnoi Khimii* (Journal of Applied Chemistry), v. 22, May 1949, p. 455-466.

Theoretical analysis. Fundamental data for a large number of metals and nonmetals. 21 ref.

4A-127. Quasi-Chemical Theory of Regulation of Binary Alloys. (In Russian.) I. A. Mirtskhulava. *Zhurnal*

Eksperimental'noi i Teoreticheskoi Fiziki (Journal of Experimental and Theoretical Physics) v. 19, May 1949, p. 407-412.

A hypothetical binary alloy at a given temperature is assumed to be a mixture of "normal" atoms and alterations of different types. Thermodynamic potentials and equilibrium numbers of alterations of different types are determined. Degrees of remote and close order of the crystal are determined according to this number, as well as drop of thermal capacity during passage through the Curie point.

4A-128. Atomic Magnetic Moments and Interatomic Distances of Metals of the Iron Group. (In Russian.) F. M. Gal'perin. *Zhurnal Eksperimental'noi i Teoreticheskoi Fiziki* (Journal of Experimental and Theoretical Physics), v. 19, May 1949, p. 451-459.

The relation between atomic magnetic moments of solid face-centered cubic metals of the iron group and their interatomic distances. 21 ref.

4A-129. Correlation Between Lattice Transformation and Plastic Flow in Metals. (In Japanese.) Sakae Takeuchi and Hidezi Suzuki. *Nippon Kinozoku Gakkai-Si* (Journal of the Japan Institute of Metals), v. 13, Apr. 1949, p. 14-18.

Two assumptions on the basis of which a thermodynamic theory of plastic deformation was developed in a preceding report are discussed from the viewpoint of a dislocation model. (Conclusions are summarized in the English abstract.)

4A-130. Strain Hardening Effects of Alloying Elements and Microstructure. G. V. Smith. *American Society for Metals*, "Cold Working of Metals", 1949, p. 2-30.

Various methods of study. Effect on flow strength. 26 ref.

4A-131. Structure of Slip Bands and Cold-Worked Metal. R. D. Heidenreich. *American Society for Metals*, "Cold Working of Metals", 1949, p. 57-64.

Application of electron microscope and electron-diffraction methods to the structure of deformed metals. Surfaces of Al single crystals after plastic deformation. Interprets transmission electron-microscope images of thin Al sections.

4A-132. The Crystallographic Mechanisms of Translation, Twinning and Banding. C. S. Barrett. *American Society for Metals*, "Cold Working of Metals", 1949, p. 65-98.

In pure, stable metals and alloys as affected by cold working. 22 ref.

4A-133. Deformation Textures. R. M. Brick. *American Society for Metals*, "Cold Working of Metals", 1949, p. 99-112.

Textures resulting from cold working. Significant variables of the relation between textures and properties. 16 ref.

4A-134. Recrystallization Textures. C. G. Dunn. *American Society for Metals*, "Cold Working of Metals", 1949, p. 113-130.

General principles applicable to the development of strong textures. Cube texture, its development and stability. New information on a texture produced in silicon iron. Both textures form on annealing after fabrication by cold rolling. 32 ref.

4A-135. Dislocation Theory. W. Shockley. *American Society for Metals*, "Cold Working of Metals", 1949, p. 131-147.

Limited aspects of the above which is felt to be in a highly unsatisfactory state as a result of introducing assumptions at various stages of the development.

4A-136. Nucleation of Deformation. J. H. Hollomon. *American Society for Metals*, "Cold Working of Metals", 1949, p. 148-162.

Nucleation of phase transformations and of slips. Transient effects and the mechanical equation of state. 14 ref.

4A-137. The Effect of Strain Histories on the Work Hardening of Metals. T. E. Tietz and J. E. Dorn. *American Society for Metals*, "Cold Working of Metals", 1949, p. 163-179.

Temperature of straining as a factor in determining the amount of work hardening in metals crystallizing in body-centered cubic and close-packed hexagonal systems. Effect of strain rate on strain hardening when temperature is held constant. Some preliminary tests on the effect of thermal-mechanical history on recovery rates. Their possible significance in identifying the influence of temperature of straining.

4A-138. Dynamics of Slip Bands. Clarence Zener. *American Society for Metals*, "Cold Working of Metals", 1949, p. 180-196.

Influence of previously formed slip bands upon the relation between stress and strain under conditions when no new slip bands are being formed. 15 ref.

4A-139. The Effect of Plastic Deformation on Solid Reactions. Part I. Diffusion Reactions. B. L. Averbach. **Part II. The Effect of Applied Stress and Strain on the Martensite Reaction.** B. L. Averbach, S. A. Kulin, and Morris Cohen. *American Society for Metals*, "Cold Working of Metals", 1949, p. 262-319.

As related to cold working. Property and constitution data are tabulated and plotted. 46 ref.

4A-140. Diffusion in Binary Alloys. J. Bardeen. *Physical Review*, ser. 2, v. 76, Nov. 1, 1949, p. 1403-1405.

Diffusion via vacant lattice sites leads to Darken's equations if it is assumed that the concentration of vacant sites is in thermal equilibrium. Modifications required if vacant sites are not in equilibrium.

4A-141. Zur Frage der Einheitlichkeit des Kristallzustandes in kaltgereckten Metallen. (Concerning the Question of Uniformity of Crystal Structure in Cold Drawn Metals.) E. Brandenberger and F. Staffelbach. *Schweizer Archiv für angewandte Wissenschaft und Technik*, v. 15, Sept. 1949, p. 259-261.

X-ray diagrams are better suited than photomicrographs for determining the degree of plastic deformation of tensile bars, especially when "pulled" at different rates. Photomicrographs and corresponding X-ray diagrams.

4A-142. Determination of Linear Rate of Transformation in Solid Metals. (In Russian.) A. G. Spektor. *Zavodskaya Laboratoriya* (Factory Laboratory), v. 15, July 1949, p. 797-799.

Bases of one method of determining rate of growth and of solution of phases in solid metals which permits determining these values for crystals of any shape with a high degree of accuracy. Collision of crystals and formation of polycrystalline junctions do not impede use of this method. Data for solution of carbide phase in austenitic steel at a heating rate of 4° C. per sec.

4A-143. Aspects of Gas-Metal Equilibrium, Interstitial Solution and Diffusion. R. M. Barrer. *Faraday Society*, "The Physical Chemistry of Process Metallurgy", Discussion No. 4, 1948, p. 68-81; discussion, p. 108-126.

Previously abstracted from *Faraday Society Transactions*, Preprint. See item 4a-48, 1948.

4A-144. The Constitution of Phases at High Temperature in Relation to Their Thermodynamic Properties. G. M. Willis. *Faraday Society*, "The Physical Chemistry of Process Metallurgy", Discussion No. 4, 1948, p. 281-286; discussion, p. 317-344.

Previously abstracted from *Faraday Society Transactions*, Preprint. See item 4a-47, 1948.

4A-145. Stable Transformation Nuclei in Solids. J. N. Hobstetter. *Transactions of the American Institute of Mining and Metallurgical Engineers*, v. 180, 1949, p. 121-130.

Previously abstracted from *Metals Technology*. See item 4a-55, 1948.

4A-146. Nucleation of Slip Bands. J. G. Leschen, R. P. Carreker, and J. H. Hollomon. *Transactions of the American Institute of Mining and Metallurgical Engineers*, v. 180, 1949, p. 131-138.

Previously abstracted from *Metals Technology*. See item 4a-49, 1948.

4A-147. Transient Plastic Deformation. R. P. Carreker, J. G. Leschen and J. D. Lubahn. *Transactions of the American Institute of Mining and Metallurgical Engineers*, v. 180, 1949, p. 139-146.

Previously abstracted from *Metals Technology*. See item 4a-50, 1948.

4A-148. Property Changes During Aging. A. H. Geisler. *Transactions of the American Institute of Mining and Metallurgical Engineers*, v. 180, 1949, p. 230-254.

Previously abstracted from *Metals Technology*. See item 18a-23, 1948.

4A-149. (Book) Crystal Growth. *Discussions of the Faraday Society*, no. 5, 1949, 366 pages. Faraday Society, 98 Great Russell St., London, England.

Proceedings of a symposium held Apr. 12-14, 1949. Consists of introductory paper, 7 papers on theory of crystal growth, 13 on nucleation and normal growth, 9 on abnormal and modified crystal growth, 13 on mineral synthesis and technical aspects, and concluding remarks. The bulk of the papers deal with pure theory or with nonmetallic crystals. Three exceptions are abstracted individually.

4B—Ferrous

4B-112. Effects of Stress and Deformation on the Martensite Transformation. Andrew W. McReynolds. *Journal of Applied Physics*, v. 20, Oct. 1949, p. 896-907.

The relation between elastic and plastic strains and the martensite transformation from face-centered to body-centered structure was investigated in Fe-Ni 71-29 alloy. Results are contrary to expectations on the basis of the usual homogeneous-shear model for the transformation mechanism. They indicate that the martensite phase becomes thermodynamically stable at M_d but that transformation does not begin until M_s.

4B-113. Precipitation From Solid Solutions of C and N in α-Iron. Charles A. Wert. *Journal of Applied Physics*, v. 20, Oct. 1949, p. 943-949.

Formation of precipitates was studied by means of the internal-friction peak associated with stress-induced interstitial diffusion of solute atoms. A transformation law was found to fit the experimental data. Using results of a derivation, mean distance between nuclei is calculated for Fe_3C.

4B-114. Free Energy and Metastable States in the Iron-Nickel and Iron-Manganese Systems. F. W. Jones and W. I. Pumphrey. *Journal of the Iron and Steel Institute*, v. 163, Oct. 1949, p. 121-131.

A study was made of transformations in Fe-rich Fe-Ni and Fe-Mn alloys at heating and cooling rates of the order of 10° C. per min. Quantitative explanation is given by application of thermodynamic principles. 23 ref.

4B-115. Concerning the Critical Point

of Toolsteel. II. Sorbite Phase. (In Japanese.) Masao Kondo and Yasuzi Mizunto. *Nippon Kinzoku Gakkai-Si* (Journal of the Japan Institute of Metals), v. 13, Apr. 1949, p. 22-24.

The critical points of hypereutectoid steel (1.18% C, 0.23% Si, 0.28% Mn, 0.017% P, 0.023% S) were measured dilatometrically on quenching in oil after the following treatments: slow cooling (lamellar pearlite); annealing (globular pearlite); oil quenching (martensite); and air cooling (sorbite) from 950° C.

4B-116. X-Ray Line-Breadths of Martensite. *Nature*, v. 164, Oct. 22, 1949, p. 712-713.

Two communications. M. A. Jaswon comments briefly on some recent work by Józef Mazur. The latter replies, indicating complete agreement with the opinion of Wheeler and Jaswon that the main factor causing broadening of the lines is internal stress. 23 ref.

4B-117. Kinetics of the Primary Stage of Martensite Dissociation. (In Russian.) G. Kurdyumov and L. Lysak. *Zhurnal Tekhnicheskoi Fiziki* (Journal of Technical Physics), v. 19, May 1949, p. 525-531.

Relationship to time of annealing at temperatures of 80, 100, and 120° C. was investigated. Results confirm the "heterogeneous" character of the primary stage of martensite dissociation and indicate that rate of formation of carbide nuclei remains approximately constant until dissociation begins, after which it decreases.

4B-118. Carbide Phase During Annealing of Alloy Steel. (In Russian.) S. Z. Bokshtein. *Zhurnal Tekhnicheskoi Fiziki* (Journal of Technical Physics), v. 19, May 1949, p. 532-541.

Transformations which take place during annealing of Cr steel. 14 ref.

4B-119. Influence of Plastic Deformation in the Martensite-Transformation Region on Position of the Martensite Point. (In Russian.) V. I. Prosvirin. *Zhurnal Tekhnicheskoi Fiziki* (Journal of Technical Physics), v. 19, May 1949, p. 542-549.

Steel containing 11.0% Cr, 3.85% Ni, and 0.34% C was studied. Attempts to explain the role of plastic deformation in the change of character of the martensite transformation on the basis of the results.

4B-120. Concerning Temperature Intervals in Lattice Transformations. (In Japanese.) Sakae Takeuchi and Hidezi Suzuki. *Nippon Kinzoku Gakkai-Si* (Journal of the Japan Institute of Metals), v. 13, Jan. 1949, p. 26-29.

Fundamental principles. Assumes existence of a relationship between the free-energy change associated with phase transformation and the mechanical energy associated with plastic deformation. From this relationship, the dependence of amount of transformation on temperature was evaluated. Calculated values for the Fe-Ni alloy containing 20% Ni agree with experimental ones.

4B-121. Sur une nouvelle famille de sesquioxydes cubiques de fer stabilisés. (Concerning a New Family of Cubic Sesquioxides of Stabilized Iron.) A. Michel and E. Pouillard. *Bulletin de la Société Chimique de France*, Jan.-Feb. 1949, p. 152.

... of production by oxidation of substituted magnetites containing Al_2O_3. For percentages of less than 7% Al_2O_3, there is an increase in the temperature of destruction of the rhombohedral form, the final product being only slightly ferromagnetic. When a higher percentage of Al_2O_3 is present, temperatures up to 600° C. do not cause destruction of the cubic form.

4B-122. La graphitation. (Graphitization.) H. Brusset. *Bulletin de la Société Chimique de France*, Jan.-Feb. 1949, p. D49-D52.

Investigated from the point of view of its mechanism and structural character. 20 ref.

4B-123. Vliv chemickeho slozeni na teplotu Ac_3 u podeutektoidnich oceli a volba kalici teploty. (The Influence of Chemical Composition on the Ac_3 Temperature of Hypo-Eutectoid Steels and Choice of Quenching Temperature.) Frantisek Sicha. *Hutnické Listy*, v. 4, June 1949, p. 169-175.

Use of dilatometric methods for study. On the basis of statistical analysis of test data, diagrams showing influence of C, Mn, Si, Ni, Cr, Mo, and V on Ac_3 temperatures were prepared. Unfavorable effect of higher quenching temperatures; optimum quenching and normalizing zones.

4B-124. Kinetics of Nitrogen Evolution From an Iron-Nitrogen Interstitial Alloy. Charles Goodeve and K. H. Jack. *Faraday Society*, "The Physical Chemistry of Process Metallurgy", Discussion No. 4, 1948, p. 82-91; discussion, p. 108-126.

Previously abstracted from *Faraday Society Transactions*, Preprint. See item 4b-86, 1948.

4B-125. Elimination of the Thermal-Diffusion Error in Studies of Gas-Metal Equilibrium. Minu N. Dastur and John Chipman. *Faraday Society*, "The Physical Chemistry of Process Metallurgy", Discussion No. 4, 1948, p. 100-108; discussion, p. 108-126.

Previously abstracted from *Faraday Society Transactions*, Preprint. See item 4b-85, 1948.

4B-126. Origin of Silicate Inclusions in Basic Electric-Arc-Furnace Steel of Higher Carbon Contents. Axel Hultgren. *Transactions of the American Institute of Mining and Metallurgical Engineers*, v. 176, 1948, p. 173-200.

Previously abstracted from *Metals Technology*. See item 4b-62, 1948.

4B-127. Effect of Hydrogen on the Ductility of Cast Steels. C. E. Sims, G. A. Moore, and D. W. Williams. *Transactions of the American Institute of Mining and Metallurgical Engineers*, v. 176, 1948, p. 283-308.

Previously abstracted from *Metals Technology*. See item 4b-94, 1948.

4B-128. Anisothermal Formation of Bainite and Pro-Eutectoid Constituents in Steels. Leonard D. Jaffe. *Transactions of the American Institute of Mining and Metallurgical Engineers*, v. 176, 1948, p. 363-376; discussion, p. 376-383.

Previously abstracted from *Metals Technology*. See item 18b-2, 1948.

4B-129. Austenite Transformation Above and Within the Martensite Range. R. T. Howard, Jr., and M. Cohen. *Transactions of the American Institute of Mining and Metallurgical Engineers*, v. 176, 1948, p. 384-397; discussion, p. 397-400.

Previously abstracted from *Metals Technology*. See item 4-161, 1947.

4B-130. Diffusion of Carbon in Austenite With a Discontinuity in Composition. L. S. Darken. *Transactions of the American Institute of Mining and Metallurgical Engineers*, v. 180, 1949, p. 430-438.

Previously abstracted from *Metals Technology*. See item 4b-83, 1948.

4B-131. The Effect of Chromium on the M_s Point. J. B. Bassett and E. S. Rowland. *Transactions of the American Institute of Mining and Metallurgical Engineers*, v. 180, 1949, p. 439-446.

Previously abstracted from *Metals Technology*. See item 4b-61, 1948.

4B-132. The Structure at a Cleavage Surface in Ferrite. E. P. Klier, D. E. Nulk, and F. C. Wagner. *Transactions of the American Institute of Mining and Metallurgical Engineers*, v. 180, 1949, p. 707-708.

Previously abstracted from *Metals Technology*. See item 4B-1, 1949.

4C—Nonferrous

4C-123. Crystal Orientation in Magnetic Alloys. Martin Littmann. *Electrical Engineering*, v. 68, Nov. 1949, p. 977-979.

For many magnetic alloys, permeability is strongly dependent on crystal orientation. 3% Si and 48% Ni irons are described in which the cube edges of the crystals are aligned with the rolling direction of the sheet, thus permitting utilization of superior permeability in that direction.

4C-124. Détermination magnétique de la constitution d'alliages paramagnétiques. Application aux alliages Cérium-Magnésium. (Magnetic Method for Determination of the Constitution of Paramagnetic Alloys. Application to Cerium-Magnesium Alloys.) Francoise Mahn. *Journal des Recherches du Centre National de la Recherche Scientifique*, no. 7, 1948, p. 145-155.

Investigation indicates that the alloys possess paramagnetism according to Weiss's law in almost the entire composition range. Constitutional diagrams of Vogel and of Haughton and Schofield are revised on the basis of the results. 23 ref.

4C-125. Influence de la répartition des imperfections de structure des cristaux de solution solide aluminium-cuivre sur le mode de précipitation de la phase θ'. (Influence of the Distribution of Structural Imperfections in the Crystal Structure of an Al-Cu Solid Solution on the Precipitation of the θ' Phase.) Paul Lacombe and Aurel Berghezan. *Comptes Rendus* (France), v. 229, Aug. 1, 1949, p. 365-367.

Castaing and Guinier have already shown, by electron-microscope study, the concentration of dissolved atoms in the intergranular region. Variation of distribution of the θ' phase with time of quenching and method of recrystallization is shown by optical microscopy.

4C-126. Contributo allo studio della morfologia delle inclusioni non metalliche nei prodotti siderurgici. Inclusioni nei ferro-cromi. (Contribution to the Study of the Morphology of Nonmetallic Inclusions in Metallurgical Products. Inclusions in Ferrochromium.) Raffaello Zoja. *La Metallurgia Italiana*, v. 41, Mar.-Apr. 1949, p. 80-94.

Inclusions in 96 specimens were examined for frequency of occurrence, size, etc., of the various types. Alpha and beta-type silicates represented about 80% of the total. Methods of investigation.

4C-127. Beitrag zur Frage der umgekehrten Blockseigerung bei Aluminium-Kupfer-Magnesium-Legierungen. (Contributions to the Problem of Inverse Ingot Segregation in Aluminum-Copper-Magnesium Alloys.) Hugo Vosskühler. *Zeitschrift für Metallkunde*, v. 40, Aug. 1949, p. 305-311.

Various theories on segregation. Contrary to earlier assumptions of a uniform Cu content across the ingot, the Cu content of an Al-Cu-Mg alloy ingot shows considerable variations not explained by prevailing theories.

4C-128. Uber die röntgenographische Untersuchung schmelzflüssiger Metalle und Legierungen. (The X-Ray Investigation of Molten Metals and Alloys.) H. F. Sauerwald. *Zeitschrift für anorganische Chemie*, v. 257, Nov. 1948, p. 195-198.

Data for molten Hg, Pb, Sn, Tl, and Hg-Pb and Hg-Tl alloys. Different results by different authors point to the possibility of differences in

the liquid structures of a given metal or alloy due to differences in melting conditions. 11 ref.

4C-129. Über die Oxydation von Silber-Kupfer-Legierungen. (The Oxidation of Silver-Copper Alloys.) Ernst Justus Kohlmeyer and Karin V. Sprenger. *Zeitschrift für anorganische Chemie*, v. 257, Nov. 1948, p. 199-214.

Proves experimentally that molten Ag-Cu alloys containing up to at least 30% Ag can be completely oxidized at 1230° C. If the alloy contains more than 30% Ag, the oxidized melt will contain unoxidized Ag in addition to Ag_2O and Cu_2O. The same results are obtained by heating an Ag_2O-CuO mixture to 1230° C. At atmospheric pressure, molten Cu_2O will dissolve up to 44 weight % Ag_2O. Includes constitution diagrams. 18 ref.

4C-130. The Binary System Chromium-Boron. I. Phase Analysis and Structure of the ζ and θ-phases. (In English.) *Acta Chemica Scandinavica*, v. 3, no. 6, 1949, p. 595-602.

The system was investigated by X-ray methods. Five intermediate phases with B contents of about 33 atomic % (δ), 40% (ε), 50% (ζ), 55% (η), and 66.7% (θ) were found to exist. Complete structure determinations of the orthorhombic ζ-phase and the hexagonal θ-phase were carried out. 13 ref.

4C-131. The Borides of Tantalum. (In English.) Roland Kiessling. *Acta Chemica Scandinavica*, v. 3, no. 6, 1949, p. 603-615.

The Ta-B system was studied by X-ray methods. Four intermediary phases exist. Complete structure determinations of each of the phases. 13 ref.

4C-132. On Two Modifications of Nickel Oxide. (In English.) Yasumitsu Shimomura and Zenji Nishiyama. *Nippon Kinzoku Gakkai-Si* (Journal of the Japan Institute of Metals), v. 13, Apr. 1949, p. 2-3.

Experimental results indicate that NiO has a rhombohedral structure. The cubic modification was also found to exist in some cases. Includes microphotometer curves of diffraction lines obtained on heating the oxide.

4C-133. A Note on the Nature of Superlattice Formation in Fe-Al Alloys. (In Japanese.) Hiroski Sato. *Nippon Kinzoku Gakkai-Si* (Journal of the Japan Institute of Metals), v. 13, Apr. 1949, p. 3-8.

Results of investigation indicate that anomalous physical properties observed in Fe-Al alloys are due to interrelations between superlattice formation and the origin of spontaneous magnetization.

4C-134. Concerning "Anomalous" Temperatures of Cu and Their Relationships. (In Japanese.) Mituru Sato and Tosiro Suzuoka. *Nippon Kinzoku Gakkai-Si* (Journal of the Japan Institute of Metals), v. 13, Apr. 1949, p. 19-22.

Analysis of literature data resulted in fixing of 230, 277, 550, and 1083° C. as "anomalous" temperatures at which there is a marked shift in the curves of temperature vs. different mechanical and physical properties.

4C-135. The Metallography of Copper Containing Small Amounts of Bismuth. L. E. Samuels. *Journal of the Institute of Metals*, v. 76, Sept. 1949, p. 91-102.

The dark lines noted at the grain boundaries of electropolished specimens of brittle Bi-containing copper are not films, as previously supposed, but step-like grooves. Deep-etched grooves are also developed at the grain boundaries of both mechanically and electropolished specimens by a number of etching reagents. A mechanism of embrittlement based on one previously advanced for temper-brittleness of steels is suggested. 12 ref.

4C-136. Das Zustandsbild Nickel-Thorium. (The Nickel-Thorium Constitution Diagram.) Lore Horn and Christl Bassermann. *Zeitschrift für Metallkunde*, v. 39, Sept. 1948, p. 272-275.

Investigated by thermal analysis, metallographic and X-ray examinations, and microhardness measurements.

4C-137. Oberflächenwanderung von Wolfram auf dem eigenen Kristallgitter. (Surface Migration of Tungsten on Its Own Crystal Lattice.) Erwin W. Müller. *Zeitschrift für Physik*, v. 126, Aug. 30, 1949, p. 642-665.

Method of determining the number of mobile atoms on the surface at elevated temperatures, based on the fact that submicroscopic tungsten tips increase, on heating, their radius of curvature which can be measured by their field emission. The nature and shape of the heated tip was investigated and the expected current density and directional dispersion of field emission calculated. 29 ref.

4C-138. Microstructural Investigation of Kinetics of the Martensite Transformation in Copper-Tin Alloys. (In Russian.) G. V. Kurdyumov and L. G. Khandros. *Zhurnal Tekhnicheskoi Fiziki* (Journal of Technical Physics), v. 19, July 1949, p. 761-768.

Investigated for alloys containing 24-25% Sn. Photomicrographs show phase transformations under different conditions.

4C-139. Investigation of Diffusion of Zinc in α-Brass in the Temperature Region 400-750° C. (In Russian.) S. Gertsriken, I. Dekhtyar, and L. Kumok. *Zhurnal Tekhnicheskoi Fiziki* (Journal of Technical Physics), v. 19, July 1949, p. 769-772.

The study revealed a point of inflection in the curve of temperature vs. diffusion coefficient near 450° C. Energy and entropy of activation for both branches of this curve were determined. Anomalous behavior is explained by the influence of internal local deformations in the lattice.

4C-140. Thermodynamics of Lead-Zinc Alloys. John Lumsden. *Faraday Society*, "The Physical Chemistry of Process Metallurgy", Discussion No. 4, 1948, p. 60-68; discussion, p. 108-126.

Previously abstracted from *Faraday Society Transactions*, Preprint. See item 3c-85, 1948.

4C-141. Plastic Deformation of Large Grained Copper Specimens. W. R. Hibbard, Jr. *Transactions of the American Institute of Mining and Metallurgical Engineers*, v. 180, 1949, p. 52-72.

Previously abstracted from *Metals Technology*. See item 4c-73, 1948.

4C-142. Some Factors Affecting the Rate of Grain Growth in Metals. J. E. Burke. *Transactions of the American Institute of Mining and Metallurgical Engineers*, v. 180, 1949, p. 73-91.

Previously abstracted from *Metals Technology*. See item 4c-78, 1948.

4C-143. The Kappa Eutectoid Transformation in the Copper-Silicon System. W. R. Hibbard, Jr. *Transactions of the American Institute of Mining and Metallurgical Engineers*, v. 180, 1949, p. 92-100.

Previously abstracted from *Metals Technology*. See item 4c-72, 1948.

4C-144. Mechanism of Precipitation in a Permanent Magnet Alloy. A. H. Geisler and J. B. Newkirk. *Transactions of the American Institute of Mining and Metallurgical Engineers*, v. 180, 1949, p. 101-120.

Previously abstracted from *Metals Technology*. See item 4c-60, 1948.

4C-145. The Cobalt-Chromium Binary System. A. R. Elsea, A. B. Westerman, and G. K. Manning. *Transactions of the American Institute of Mining and Metallurgical Engineers*, v. 180, 1949, p. 579-602.

Previously abstracted from *Metals Technology*. See item 4c-42, 1948.

4C-146. Platinum-Tungsten Alloys. R. I. Jaffee and H. P. Nielsen. *Transactions of the American Institute of Mining and Metallurgical Engineers*, v. 180, 1949, p. 603-615.

Previously abstracted from *Metals Technology*. See item 4c-58, 1948.

4C-147. Fractographic Study of Cast Molybdenum. C. A. Zapffe, E. K. Landgraf, and C. O. Worden. *Transactions of the American Institute of Mining and Metallurgical Engineers*, v. 180, 1949, p. 616-636.

Previously abstracted from *Metals Technology*. See item 4c-59, 1948.

4D—Light Metals

4D-62. Oriented Arrangements of Thin Aluminium Films Formed on Ionic Substrates. T. N. Rhodin, Jr. *Discussions of the Faraday Society*, No. 5 (Crystal Growth), 1949, p. 215-233.

Previously abstracted from *Journal of Metals*. See item 4D-32, 1949.

4D-63. Über die Deutung der Entmischungsvorgänge in Mischkristallen unter besonderer Berucksichtigung der Systeme Aluminium-Kupfer und Aluminium-Silber. (The Significance of Precipitation Phenomena in Solid Solutions With Special Attention to the Aluminum-Copper and Aluminum-Silver Systems.) Heinz Jagodzinski and Fritz Laves. *Zeitschrift für Metallkunde*, v. 40, Aug. 1949, p. 296-305.

Problem of diffusion and of the closely related formation of nuclei. Guinier's theory is critically evaluated and his results compared with those of the present authors for grain dimensions of Al-Cu and Al-Ag alloys. 28 ref.

4D-64. A New Phase in the System Al-Si-Li. (In Russian.) E. A. Boom. *Doklady Akademii Nauk SSSR* (Reports of the Academy of Sciences of the USSR), new ser., v. 66, June 1, 1949, p. 645-646.

The nature of an Al-Si alloy modified by addition of Li was investigated metallographically. Results indicate presence of a new phase in alloys of high Li content. This new phase appears to be $Li_4Al_4Si_4$.

4D-65. Effect of Composition on Grain Growth in Aluminum-Magnesium Solid Solutions. L. J. Demer and P. A. Beck. *Transactions of the American Institute of Mining and Metallurgical Engineers*, v. 180, 1949, p. 147-162.

Previously abstracted from *Metals Technology*. See item 4d-18, 1948.

4D-66. Effect of a Dispersed Phase on Grain Growth in Al-Mn Alloys. P. A. Beck, M. L. Holzworth and P. R. Sperry. *Transactions of the American Institute of Mining and Metallurgical Engineers*, v. 180, 1949, p. 163-192.

Previously abstracted from *Metals Technology*. See item 4d-40, 1948.

4D-67. Solubility of Iron in Solid Aluminum. J. K. Edgar. *Transactions of the American Institute of Mining and Metallurgical Engineers*, v. 180, 1949, p. 225-229.

Previously abstracted from *Metals Technology*. See item 4d-19, 1948.

4D-68. Some Effects of Applied Stresses on Precipitation Phenomena. W. L. Finlay and W. R. Hibbard, Jr. *Transactions of the American Institute of Mining and Metallurgical Engineers*, v. 180, 1949, p. 255-272.

Previously abstracted from *Metals Technology*. See item 4d-39, 1948.

4D-69. Hydrogen in Aluminum. Y. Dardel. *Transactions of the American*

Institute of Mining and Metallurgical Engineers, v. 180, 1949, p. 273-286.

Previously abstracted from *Metals Technology*. See item 4D-1, 1949.

For additional annotations indexed in other sections, see:
2C-82; 3A-212-216-231; 3B-236-247-258; 3C-209-221-226; 6A-153; 7A-186; 8-303; 11-341-355; 18A-34; 18B-211-213-214-219-221; 19A-246

5A—General

5A-59. Untersuchungen über die Bedeutung des Begriffes "Fulldichte" als Kenngrösse für die Eigenschaften von Metallpulvern. (Research on the Meaning of the Term "Bulk Density" as an Index for the Properties of Metal Powders.) H. Bernstorff and F. Moser. *Archiv für Metallkunde*, v. 3, Sept. 1949, p. 317-323.

The volume of a given weight of loosely poured powder depends on size, density, porosity, and surface condition of the individual grains. The change in "bulk density" resulting from addition of 0.3-1.5% graphite depends on structure, form, and size of the grains of iron powder. Shows that the grain structure and size of a sintered article before and after annealing depend largely on bulk density of the powder.

5A-60. Seminar on the Kinetics of Sintering. A. J. Shaler. *Journal of Metals* (Transactions Section), v. 1, Nov. 1949 (*Transactions of the American Institute of Mining and Metallurgical Engineers*, v. 185) p. 796-804; discussion, p. 804-813.

Critical analysis of literature data and results of simple experiments. In a limited range of cases, it is now feasible to predict the course of sintering with some precision, and some observations can now be interpreted with less difficulty. 29 ref.

5A-61. Fundamental Study, and Equipment for Sintering and Testing of Cermet Bodies: IV. Developing and Testing Equipment. T. S. Shevlin and A. R. Blackburn. *Journal of the American Ceramic Society*, v. 32, Nov. 1, 1949, p. 363-366.

A relatively large molybdenum-wound resistor furnace, a diamond-wheel rod-grinding machine, a tensile stress-rupture machine, and thermal-expansion equipment used for the development and testing of cermets.

5A-62. Pulvermetallurgie: Grundlagen, Aussichten und Zukunftsaufgaben. (Powder Metallurgy: Principles, Prospects, and Future Problems.) Hans Schrader and Hermann Fahlenbrach. *Zeitschrift des vereines Deutscher Ingenieure*, v. 91, Oct. 1, 1949, p. 485-492.

An experimental and theoretical contribution to the above. 37 ref.

5A-63. Lead-Grid Study of Metal Powder Compaction. R. Kamm, M. A. Steinberg, and J. Wulff. *Transactions of the American Institute of Mining and Metallurgical Engineers*, v. 180, 1949, p. 694-706.

Previously abstracted from *Metals Technology*. See item 5A-2, 1949.

5C—Ferrous

5C-21. Metallographic Study of the Sintering Process. G. A. Geach and F. O. Jones. *Research*, v. 2, Oct. 1949, p. 493-494.

Technique and results obtained with Cu heated in hydrogen. Effects of varying time and temperature of sintering and diameter of the wire.

5C-22. A Process for Hot Pressing Beryllium Powder. A. U. Seybolt, R. M. Linsmayer, and J. P. Frandsen. *U. S. Atomic Energy Commission*, AECD 2679, Aug. 18, 1949, 23 pages.

Hot pressed powder compacts up to 12-in. diam. and 4 in. thick of practically theoretical density were made. Radiographic and metallographic examination show Be to be quite uniform and structurally dense. Tensile-test data indicate properties comparable to Be fabricated from castings.

5C-23. Some Aspects of the Production and Heat Treatment of Electrolytic Copper Powder. H. J. V. Tyrrell. *Journal of the Institute of Metals*, v. 76, Sept. 1949, p. 17-42.

Preparation from acid copper sulfate and acid sodium cupro-chloride electrolytes was studied on a laboratory scale. The powders prepared from the two electrolytes were quite different both in appearance and properties. Effects of heat treatment on properties were studied. The annealing atmosphere was of great importance in determining stability of the powder. It was found possible to stabilize such powders by coating the particles with a monolayer of stearate ions. Relationships between tensile strength of sintered compacts and annealing temperature, forming pressure, density, and change in density on sintering were investigated. 14 ref.

5C-24. Production of Platinum by Powder Metallurgy. A. B. Middleton, L. B. Pfeil, and E. C. Rhodes. *Engineering*, v. 168, Oct. 21, 1949, p. 431-433. Condensed from "Pure Platinum of High Recrystallisation Temperature, Produced by Powder Metallurgy".

Previously abstracted from *Journal of the Institute of Metals*. See item 5C-10, 1949.

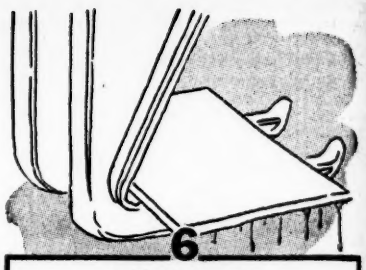
5C-25. The Pore Size of Hydrogen Reduced Tungsten Powder. B. Kopelman and C. C. Gregg. *Transactions of the American Institute of Mining and Metallurgical Engineers*, v. 180, 1949, p. 666-671.

Previously abstracted from *Metals Technology*. See item 5c-25, 1948.

For additional annotations indexed in other sections, see:
23A-34

Abstracts of 1151 articles on
CORROSION

Published during the past five years are available to you. *Complete your set of five volumes of A.S.M. Review of Metal Literature now.* Order from American Society for Metals, 7301 Euclid Ave., Cleveland 3, Ohio.



6A—General

6A-123. Iron Changes Corrosion Resistance of Copper-Nickel-Iron Alloy Tubes. W. Lynes. *Power*, v. 93, Nov. 1949, p. 84-85.

How and why of condenser-tube behavior in regard to pitting, corrosion, and impingement. Alloy make-up determines suitability of tubes for use with certain water conditions.

6A-124. Hydrofluoric Acid Versus Construction Materials. Part III. (Concluded.) *Chemical Engineering*, v. 50, Oct. 1949, p. 227-228, 230, 232, 234, 236, 238.

Includes the following sections: "Lead", Kempton H. Roll; "Silicones", J. A. McHard and A. F. Kolb; "Nickel, Nickel Alloys", W. Z. Friend; "Durimet-20", Walter A. Luce; "Rubber-Lined", C. L. Lockman; and "Protective Coatings", Kenneth Tator. Not recommended for use with HF are chemical stoneware (F. E. Herstein), tantalum (Allan L. Percy), glass-lined steel (S. W. McCann), and aluminum (Ellis D. Verink, Jr.).

6A-125. Corrosion. R. S. Peoples and F. W. Fink. *Metals Review*, v. 22, Oct. 1949, p. 4-7.

Survey of the year's literature points up the urgent need of conserving raw materials by protective and preventive measures. Includes references on corrosion-preventive coatings. (References to ASM Review of Current Metal Literature.)

6A-126. Electrochemical Principles of Cathodic Protection. R. H. Brown and G. C. English. *National Association of Corrosion Engineers*, "Cathodic Protection; A Symposium", 1949, p. 7-11.

Theory of cathodic protection developed from the local cell picture of electrochemical corrosion. Since both polarization and IR drop through the film resistance contribute to cathode potential, equations are formulated having terms representing each effect. Chemical changes due to continued passage of current. Includes circuit diagrams. 12 ref.

6A-127. Characteristics and Field Use of Electrical Instruments for Corrosion Investigations and Cathodic Protection. M. C. Miller. *National Association of Corrosion Engineers*, "Cathodic Protection; A Symposium", 1949, p. 12-33.

Recommended procedures. Includes circuit diagrams.

6A-128. Characteristics of Half-Cells Used as Reference Electrodes. Paul Fugassi. *National Association of Corrosion Engineers*, "Cathodic Protection; A Symposium", 1949, p. 34-36.

Measurement of thermodynamic and nonthermodynamic quantities. Cell used for control of cathodic-protection methods. 10 ref.

6A-129. Laboratory Methods for Determining the Current Required for Cathodic Protection. R. B. Mears and J. M. Bialosky. *National Association of*

Corrosion Engineers, "Cathodic Protection; A Symposium", 1949, p. 37-46.

Direct, analytical, indirect, zero-current, and zero-potential methods. Correlation with current of freely corroding specimen. 36 ref.

6A-130. Current Required for Cathodic Protection. N. P. Peifer. *National Association of Corrosion Engineers*, "Cathodic Protection; A Symposium", 1949, p. 47-53.

12 references.

6A-131. Detection, Measurement and Mitigation of Stray-Current Electrolysis. Frank B. Fry. *National Association of Corrosion Engineers*, "Cathodic Protection; A Symposium", 1949, p. 54-56.

Reviews methods.

6A-132. Detection and Measurement of Currents Other Than Stray Currents, Including Magnetic Earth Currents. Lyle R. Sheppard. *National Association of Corrosion Engineers*, "Cathodic Protection; A Symposium", 1949, p. 57-63; discussion, p. 63-65.

Currents caused by electrochemical cells, thermocouples, metal stress differences, changes in magnetic fields, and microbiological action. Circuits developed for resistance and potential-difference measurements which minimize errors attributable to polarization and measuring circuit resistance. 16 ref.

6A-133. Coordination of Cathodic Protection Installations To Avoid Interference With Adjacent Structures. L. B. Nelson. *National Association of Corrosion Engineers*, "Cathodic Protection; A Symposium", 1949, p. 66-68, 69-72; discussion, p. 68-69.

Conditions that directly affect interference. Methods now used to determine and avoid it.

6A-134. Use of Rectifiers as an External Source of Protective Currents. F. A. Waelterman. *National Association of Corrosion Engineers*, "Cathodic Protection; A Symposium", 1949, p. 73-75, 76; discussion, p. 75.

Practical consideration in design and application of rectifiers to cathodic protection.

6A-135. The Use of Wind-Driven Generators as an External Source of Protective Currents. M. L. Jacobs. *National Association of Corrosion Engineers*, "Cathodic Protection; A Symposium", 1949, p. 77; discussion, p. 77-79.

New system of using wind electric generators in combination with Mg anodes to secure a system of continuous cathodic protection for pipelines.

6A-136. Economic Factors Bearing on Application of Cathodic Protection. D. B. Good. *National Association of Corrosion Engineers*, "Cathodic Protection; A Symposium", 1949, p. 80-81, 82-87; discussion, p. 82.

6A-137. Locations and Materials for Anodes for Impressed Current. Derk Holsteyn. *National Association of Corrosion Engineers*, "Cathodic Protection; A Symposium", 1949, p. 88-92.

Design of a cathodic unit installation.

6A-138. Relative Merits of Various Cathodic Protection Current Sources. G. R. Olson and C. W. Evans. *National Association of Corrosion Engineers*, "Cathodic Protection; A Symposium", 1949, p. 93-96.

Limitations and advantages of each source.

6A-139. Physical and Chemical Characteristics of Zinc Anodes. E. A. Anderson. *National Association of Corrosion Engineers*, "Cathodic Protection; A Symposium", 1949, p. 97-100.

Relation to cathodic protection.

6A-140. Practical Use of Galvanic Anodes. Hugo W. Wahlquist and Henry M. Fanett. *National Association of Corrosion Engineers*, "Cathodic Protection; A Symposium", 1949, p. 114-143.

Particular emphasis on Zn and Mg anodes used for cathodic protection of pipelines. Type of line, coated or bare, character and resistivity of soil, current requirement, climate, rainfall, location, accessibility for maintenance, and presence of large stray or long-line currents. 19 ref.

6A-141. Effect of Environment Characteristics on Cathodic System Design. F. J. LeFebvre and L. P. Sudrabin. *National Association of Corrosion Engineers*, "Cathodic Protection; A Symposium", 1949, p. 185-188; discussion, p. 188.

Effects of water characteristics on design and operation of cathodic protection systems.

6A-142. Relations Between Protective Coatings and Cathodic Protection. Guy Corfield. *National Association of Corrosion Engineers*, "Cathodic Protection; A Symposium", 1949, p. 189-191; discussion, p. 190.

Electric energy requirements for protection of underground piping having coatings of various degrees of electrical resistivity.

6A-143. Cathodic Protection in the Control of Stress-Corrosion Cracking. Hugh J. McDonald and James T. Waber. *National Association of Corrosion Engineers*, "Cathodic Protection; A Symposium", 1949, p. 192-197, 199-203; discussion, p. 197-198.

Effect of the large difference in anodic and cathodic area on protective current density. The effect of stressing within the plastic range on electrode potential of a metal. The role of electrical protection in corrosion fatigue. 17 ref.

6A-144. Kure Beach Begins Its Fifteenth Year. *Inco*, v. 23, Fall 1949, p. 4-7

Corrosion-testing station for seawater and marine-atmosphere testing.

6A-145. Effects of Corrosion of Aluminum Electric Cables. Results of French Investigation. *Wire Industry*, v. 16, Oct. 1949, v. 823-824.

Results of inspection of war-damaged Al-steel power cables. These cables were made by winding aluminum wires around a galvanized steel core.

6A-146. Corrosion. Mars G. Fontana. *Industrial and Engineering Chemistry*, v. 41, Nov. 1949, p. 83A-84A.

Effects on oxidation resistance of alloying Fe, Ti, and Mo with Cr discussed on the basis of the literature.

6A-147. Corrosion Tests in the Processing of Soap and Fatty Acids. W. Z. Friend and J. F. Mason, Jr. *Corrosion*, v. 5, Nov. 1949, p. 355-367; discussion, p. 367-368.

Tests made in operating equipment in soap and fatty acid plants during the past 10 years, using mostly the spool-type testing device. The program included nickel, Monel, Inconel, and other high-nickel alloys, stainless steels, copper and copper alloys, aluminum, chemical lead, mild steel, alloy steels, and plain and alloy cast irons.

6A-148. Cooperative Corrosion Testing in the Wood Pulping Industry. T. R. Gaulke and M. A. Scheil. *Corrosion*, v. 5, Nov. 1949, p. 392-401; discussion, p. 401-402.

How a cooperative corrosion testing program can be used to select the proper material for a particular job; how heat treatment, welding, and working this material influence its corrosion resistance, and guide the equipment manufacturer in his methods of fabrication.

6A-149. Korrosion metallischer Werkstoffe im Bauwesen. (Corrosion of Metallic Materials in the Construction Industry.) J. Friedli. *Schweizer Archiv für angewandte Wissenschaft und Technik*, v. 15, Sept. 1949, p. 261-265.

Chemicals (especially chlorides) added to mortar and to cement, and the presence of moisture, are the most important factors in corrosion of ferrous and nonferrous structural metals. Photographs and a table show the degree of corrosiveness of 20 different materials.

6A-150. Theory of Formation of Oxide Films on Alloys. (In Russian.) A. N. Orlov and A. A. Smirnov. *Zhurnal Tekhnicheskoi Fiziki* (Journal of Technical Physics), v. 19, May 1949, p. 550-559.

Further development of the theory of high-temperature oxidation of binary alloys using a model developed previously by one of the authors. Influence of temperature on rate of oxidation.

6A-151. Polarization Method for Accelerated Corrosion Testing of Metals in Sea Water. (In Russian.) L. V. Elin and E. Sh. Ryt. *Zavodskaya Laboratoriya* (Factory Laboratory), v. 15, July 1949, p. 811-813.

Modification of method developed originally by G. V. Akim consists of application of a ballistic galvanometer as the measuring device, thus simplifying the circuit. Corrosion stability is determined from the differential polarization curve, relating the current to the potential difference between two specimens of the metal being tested.

6A-152. L'oxydation des métaux. (Oxidation of Metals.) N. F. Mott. *Bulletin de la Société Chimique de France*, Jan.-Feb. 1949, p. D84-D88.

Attempts to establish a new and more satisfactory method of metal oxidation on the basis of rates of formation of oxide film on the metal as a function of time and temperature; mechanism of adherence of oxide to the metal surface; and structure and orientation of the oxide film. 21 ref.

6A-153. L'oxydation des métaux et les réactions dans l'état solide. (Oxidation of Metals and Reactions in the Solid State.) Jacques Bénard. *Bulletin de la Société Chimique de France*, Jan.-Feb. 1949, p. D89-D95.

Oxidation at high temperatures was investigated with particular emphasis on kinetics, mechanism of film growth, and influence of crystal orientation on rate of oxidation. 10 ref.

6A-154. Oxide Films Formed on Metals and Binary Alloys. An Electron Diffraction Study. J. W. Hickman. *Transactions of the American Institute of Mining and Metallurgical Engineers*, v. 180, 1949, p. 547-564.

Previously abstracted from *Metals Technology*. See item 6A-1, 1949.

6A-155. (Book) Chemistry Research, 1947. 91 pages. 1949. His Majesty's Stationery Office, London. 2s., net.

General activities of British governmental research organization and current research by the various groups which include corrosion of metals.

6B—Ferrous

6B-164. The Mechanism of Inhibition of Corrosion of Iron by Chromic Acid and Potassium Chromate. J. E. O. Mayne and M. J. Pryor. *Journal of the Chemical Society*, July 1949, p. 1831-1835.

Proposes that the iron ions are oxidized, while still in the solid lattice, to γ-ferric oxide, which forms a thin continuous film on the iron. This film is impervious to iron ions, and thus corrosion is prevented.

6B-165. The Passivity of Metals. Part IX. The Solubility Product of Freshly Precipitated Ferric Hydroxide. U. R. Evans and M. J. Pryor. *Journal of the Chemical Society*, Suppl. issue no. 1, 1949, p. S157-S160.

Solubility product was determined by an electrometric method. This quantity is of interest in the study of certain corrosion reactions.

6B-166. Erkenntnisse über das Rosten und den Rostschutz von Eisen und Stahl (1946 und 1947). [Rusting and Rust Prevention of Iron and Steel (1946 and 1947).] Heinrich Klas. *Stahl und Eisen*, v. 69, Aug. 18, 1949, p. 610-612; Sept. 1, 1949, p. 636-639; Sept. 15, 1949, p. 678-681.

Literature review. Aug. 18: soil and water corrosion, hot-water corrosion, steam-boiler corrosion. Sept. 1: rust prevention by metallic coatings. Sept. 15: use of nonmetallic inorganic and organic coatings. 228 ref.

6B-167. Behavior of Experimental Zinc-Iron Couples Under-Ground. I. A. Denison and W. Romanoff. *National Association of Corrosion Engineers*, "Cathodic Protection; A Symposium", 1949, p. 144-152, 155-157; discussion, p. 152-154.

Field tests made by the National Bureau of Standards to study the effectiveness of Zn for the cathodic protection of iron and steel in different soil environments. 13 ref.

6B-168. Anodic Behavior of Zinc and Aluminum-Zinc Alloys in Sea Water. Thomas P. May, George S. Gordon, and S. Schuldiner. *National Association of Corrosion Engineers*, "Cathodic Protection; A Symposium", 1949, p. 158-170; discussion, p. 170-171.

Use for the cathodic protection of steel. 16 ref.

6B-169. Pickling Equipment for Severe Corrosive Conditions. Clarence B. Mitchell. *Iron Age*, v. 164, Nov. 3, 1949, p. 92-93.

Use of an unusual combination of five different alloys yields maximum strength and corrosion resistance at minimum cost. Hastelloy alloys B and C were used in the hooks, and the bars were made of Hastelloy Alloy B and SAE 4340 and 1035 steels. Parts were assembled by welding.

6B-170. Experience and Economic Benefits From Cathodic Protection on Gas Distribution Systems. A. W. Peabody and C. L. Woody. *Corrosion*, v. 5, Nov. 1949, p. 369-376.

6B-171. Electrolytic Corrosion of Steel in Concrete. G. M. Magee. *Corrosion*, v. 5, Nov. 1949, p. 378-380; discussion, p. 380-382.

Corrosion in the concrete footings for the steel structures of electric railways. Test installation; effects of various preventive measures and variations in concrete mix.

6B-172. Corrosion in Petroleum Processes Employing Aluminum Chloride. R. S. Treseder and A. Wachter. *Corrosion*, v. 5, Nov. 1949, p. 383-391; discussion, p. 391.

Many petroleum processes use either of two types of anhydrous liquid catalysts containing aluminum chloride with hydrogen chloride present as catalyst promoter. For the $AlCl_3$-hydrocarbon type, 0.4% $SbCl_3$ has given satisfactory inhibition in one process. The $AlCl_3$-$SbCl_3$ type is less corrosive, but in some cases corrosion-resistant alloys are required. Factors affecting both types of corrosion and probable mechanisms.

6B-173. Attack of Hydrogen-Nitrogen Mixtures on Steels at 13,000 to 15,000 Pounds Per Square Inch Pressure and 204° to 593° C. Harry K. Ihrig. *Industrial and Engineering Chemistry*, v. 41, Nov. 1949, p. 2516-2521.

It is believed that austenitic Cr-Ni stainless steels are best for use at high pressures of hydrogen and nitrogen. However, it is recommended that samples of these steels be removed after periods of operation to determine whether attack has been progressive.

6B-174. Methods of Prevention and Removal of Corrosion From Steel Structures. W. C. Harman, M. Block, and W. K. Manning. *Railway Engineering and Maintenance*, v. 45, Nov. 1949, p. 1086-1087; discussion, p. 1087-1088.

Advantages and disadvantages of the different methods, including use of corrosion resistant metals.

6B-175. Use of Ammonia in Control of Vapor-Zone Corrosion in Storage Tanks. F. T. Gardner, A. T. Clothier, and F. Coryell. *Oil and Gas Journal*, v. 48, Nov. 10, 1949, p. 238, 241-242, 245-246. Ammonia Used to Control Vapor Zone Corrosion (a condensation), *Petroleum Engineer*, v. 21, Nov. 1949, p. D18, D20.

Results of several years' experience. Includes laboratory work and field tests.

6B-176. Cathodic Protection in an Oil Refinery. Derk Holsteyn. *Oil and Gas Journal*, v. 48, Nov. 10, 1949, p. 319-320, 323-324, 327-328, 330.

System which has proved practical and economical on bare networks of pipe lines and storage-tank bottoms found in an oil refinery.

6B-177. External Corrosion of Furnace-Wall Tubes. III. Further Data on Sulphate Deposits and the Significance of Iron Sulphide Deposits. R. C. Corey, G. A. Grabowski, and B. J. Cross. *Transactions of the American Society of Mechanical Engineers*, v. 71, Nov. 1949, p. 951-962; discussion, p. 962-963.

Extended studies begun in 1942 show that liquid alkali-metal pyrosulfates can be formed under operating conditions from deposits of alkali-metal sulfates on the tubes. Rate of attack will be considerably higher than when the sulfates, or "enamel" deposits, do not form a liquid phase. Phase boundaries for three compositions were established. Conditions for thermal decomposition of coal ash, leading to formation of the SO_3 necessary for the corrosion process, were determined.

6B-178. Field and Laboratory Tests of Sodium Chromates and Alkalies for Controlling Corrosion in Gas Condensate Wells. Part 5. Analysis of Field Test Results. C. K. Eilerts, R. V. Smith, F. G. Archer, L. M. Burman, Faye Greene, and H. C. Hamontre. *World Oil*, v. 129, Nov. 1949, p. 156-158, 162, 164, 166, 168, 170.

(To be concluded.)

6B-179. Mesures électrochimiques de la corrodabilité des alliages ferreux. (Electrochemical Determination of Corrodibility of Ferrous Alloys.) Leo Cavallaro and Antonio Indelli. *Métaux & Corrosion*, v. 24, June 1949, p. 149-156.

A relationship was experimentally established between weight loss and electrochemical data for a series of alloy steels in different electrolytes, using different inhibitors. Results show the possibility of electrochemical determination of corrodibility in different media. 40 ref.

6B-180. Adsorption Passivation of Iron by Protein Films. (In Russian.) G. S. Koshurnikov. *Zhurnal Prikladnoi Khimii* (Journal of Applied Chemistry), *v.* 22, July 1949, p. 698-702.

Gelatin-nitrophenol adsorption layers passivate iron in the presence of acid solutions. Casein-phosphate adsorption layers passivate it not only in the presence of acid but also in the presence of aggressive salt media. 10 ref.

6C—Nonferrous

6C-73. The Corrosive Sulphur Test. G. Claxton and K. H. V. French. *Journal of the Institute of Petroleum*, v. 35, July 1949, p. 496-507.

Addition to the copper-strip test by which it is possible to study the corrosion of copper by motor fuels on a more quantitative basis than previously. This addition depends upon conversion of the sulfide stain on the strip into H_2S, which is estimated colorimetrically. The mutual activation of corrosion by H_2S and elementary sulfur was studied quantitatively. 13 ref.

6C-74. Beiträge zur Kenntnis der Korrosionserscheinungen des Zinks im Leclanché-Element. (Corrosion Phenomena of Zinc in Leclanché Cells.) C. Drotschmann. *Metall*, v. 3, Mar. 1949, p. 84-87.

New information concerning the effects of electrolyte composition, and of changes in the electrolyte caused by discharge, on zinc corrosion in the cell.

6C-75. Corrosion of Powdered Copper. (In Russian.) A. I. Levin and A. V. Pomosov. *Zhurnal Prikladnoi Khimii* (Journal of Applied Chemistry), v. 22, June 1949, p. 592-599.

Corrosion at different temperatures in atmospheres of NH_3. Moisture is shown to be a basic factor. Experimental method.

6C-76. Corrosion and Protection of Underground Power Cables. L. J. Gorman. *National Association of Corrosion Engineers*, "Cathodic Protection; A Symposium", 1949, p. 172-180, 181-184; discussion, p. 180-181.

The component parts of the underground power-system plant, together with conditions under which they operate. Causes of corrosion. Methods of mitigating corrosion which have been found successful. Protecting armored submarine cables by proper design. 15 ref.

6C-77. Proper Bonding of Power Cable Sheath Guards Against Galvanic Corrosion. W. D. Sanderson. *Corrosion*, v. 5, Nov. 1949, p. 403.

Recommended procedure for lead sheaths.

6C-78. The Corrosion of Lead by Xylene Solutions of Lauric Acid and p-Quinone. C. F. Prutton and J. H. Day. *Journal of Physical & Colloid Chemistry*, v. 53, Oct. 1949, p. 1101-1117.

Mechanism and kinetics.

6C-79. Admiralty Condenser and Heat-Exchanger Tubing in Oil Refinery Service. Wilson Lynes. *Petroleum Engineer*, v. 21, Nov. 1949, p. C42-C44, C47.

Comparison of the performance of plain and inhibited Admiralty tubes (70% Cu, 29% Zn, 1% Sn). Failure of plain Admiralty is usually caused by dezincification. This is unusual for inhibited Admiralty. Intergranular corrosion and cracking are rare causes of failure, but transgranular cracking is an important cause in oil refineries.

6C-80. An Electron Diffraction Study of the Oxide Films Formed on Nickel-Chromium Alloys. J. W. Hickman and E. A. Gulbransen. *Transactions of the American Institute of Mining and Metallurgical Engineers*, v. 180, 1949, p. 519-533.

Previously abstracted from *Metals Technology*. See item 6c-21, 1948.

6C-81. An Electron Diffraction Study of Oxide Films Formed on Copper-Nickel Alloys at Elevated Temperatures. J. W. Hickman and E. A. Gulbransen. *Transactions of the American Institute of Mining and Metallurgical Engineers*, v. 180, 1949, p. 534-546.

Previously abstracted from *Metals Technology*. See item 6c-22, 1948.

6D—Light Metals

6D-30. Current Output of Light Metal Galvanic Anodes as a Function of Soil Resistivity. E. D. Verink, K. K. Reid, and E. R. Diggins. *National Association of Corrosion Engineers*, "Cathodic

Protection; A Symposium", 1949, p. 101-103.

Data obtained from Alcoa test installations.

6D-31. Fundamental Characteristics of Magnesium Galvanic Anodes. H. A. Robinson. *National Association of Corrosion Engineers*, "Cathodic Protection; A Symposium", 1949, p. 104-113.

Properties of Mg and its characteristics as an anode. Various factors affecting anode performance.

6D-32. Corrosion-Inhibited Fuels. Josef M. Michel and Karl F. Hager. *Industrial and Engineering Chemistry*, v. 41, Nov. 1949, p. 2616-2626.

Known methods and recent advances in the field of corrosion prevention in pipelines, storage containers, tanks, and other equipment in contact with fuels. Research on inhibitors, particularly with regard to prevention of ethyl-fuel corrosion of light-metal (Mg) tanks in airplanes. It was found that, without regard to construction materials used, even a small addition of Mepasin-sulfamide-acetic acid-sodium salt prevents any corrosion 54 ref.

6D-33. Aluminium als Baustoff in Kältemaschinen mit Chlormethyl als Kältenmittel. (Aluminum as Structural Material in Refrigerators With Methyl Chloride as Refrigerant.) Kurt Zimmer. *Chemische Technik*, v. 1, Aug. 1949, p. 69.

Tests made to determine the suitability of a cast Al compressor. Chemically impure Al is believed to be the reason for the high corrosiveness of methyl chloride on Al. Experiments with dry SO_2 produced no corrosion.

For additional annotations indexed in other sections, see:
3B-238; 3C-229; 4C-129; 7B-230; 23D-122-123

CLEANING and FINISHING

7A—General

7A-169. Refinishing Metal Ware; Stripping—Polishing—Cleaning—Replating. J. Haas. *Metal Industry*, v. 75, Oct. 7, 1949, p. 289-290. Condensed from *Metal Finishing*.

Recommended procedures.

7A-170. Large Overhead Drying Oven Features the Kaiser-Frazer Interior Trim Hardware Finishing Line. *Industrial Heating*, v. 16, Oct. 1949, p. 1824-1828, 1830, 1838.

7A-171. Porcelain Enamel Process Defects: Causes and Possible Cures. Part XI. Eggshelling, Orange Peel. M. E. McHardy. *Ceramic Industry*, v. 53, Nov. 1949, p. 59, 61.

7A-172. Metal Plating From Carbonyl Gases. *Chemical Engineering*, v. 50, Oct. 1949, p. 118-119.

Gives details of process and experimental work being done. Compared with electroplating, gas plating is said to be faster, give better reproduction of irregular surfaces, and to be applicable to nonconductors such as wood and glass.

7A-173. Materials Used in Polishing and Buffing. *Plating*, v. 36, Oct. 1949, p. 1012-1018; Nov. 1949, p. 1127-1130.

Oct.: polishing wheels, buffs, abrasive coating for polishing wheels, and bonding agents. Nov.: glue for setting up polishing wheels; polishing and buffing compounds. General Motors standards are given.

7A-174. Preparation of Wheels for Polishing and Buffing. *Plating*, v. 36, Nov. 1949, p. 1132-1135.

Procedures of General Motors Overseas Operations, for putting polishing wheels into operation, reconditioning of used polishing wheels, and preparation of buffs for buffing.

7A-175. Recent Developments in Determining Degree of Surface Cleanliness. Allen G. Gray. *Products Finishing*, v. 14, Nov. 1949, p. 70, 72, 74, 76, 78, 80, 82, 84, 86.

7A-176. Testing Organic Finishes. *Die Castings*, v. 7, Nov. 1949, p. 43-46, 48.

Developments as applied to finishes on metal products.

7A-177. Some Aspects of De-Burring and Polishing in Barrels. Hans Weiss. *Journal of Electrodepositors' Technical Society*, v. 24, 1949, p. 171-180. (Preprint.)

The barrelling process and its effects on different surfaces. Newer methods. A variety of articles of substantial size and weight can be treated in barrels under appropriate conditions.

7A-178. Pre-Finishing Surface Requirements for Mill Forms. Edward Engel. *Tool Engineer*, v. 23, Nov. 1949, p. 37-38.

For die castings, investment castings, permanent-mold castings, extruded shapes, and impact operations. Includes table of forging operations and equipment.

7A-179. A Review of De-Enameling Practice. G. H. Spencer-Strong. *Finish* v. 6, Nov. 1949, p. 33-34, 67-68, 70.

Detailed accounts of various methods.

7A-180. Electrical Measurements on Metal Protective Paints. W. E. Shaw and D. L. Hawke. *Organic Finishing*, v. 10, Oct. 1949, p. 19-22.

Measurements of bulk potential, resistance, and capacitance or dielectric constant have been used for evaluating metal protective paints. These three types of measurements as related to metal protective paints on steel. The experimental setup. An explanation of the source of certain of the phenomena measured.

7A-181. Electro-Metallizing Techniques. Thomas A. Dickinson. *Ceramic Age*, v. 54, Oct. 1949, p. 204-206.

"Cathode sputtering" and "evaporation coating", related processes used for applying both transparent and opaque metal coatings to glass, and other ceramic-product surfaces.

7A-182. Heatless De-Greasing in 10 Seconds by Ultrasonic Waves. *Factory Management and Maintenance*, v. 107, Nov. 1949, p. 130.

How an ordinary caustic cleaning solution can remove either heavy or light grease from steel parts in 10 sec. by use of ultrasonic vibrations.

7A-183. Protective Metal Finishes for Radio and Electrical Equipment. A. G. Sussex. *Department of Supply and Development, Munitions Supply Laboratories, Commonwealth of Australia*, Circular 9, Mar. 1948, 38 pages.

Selection and use of electroplated and chemical surface finishes for tropical areas. Corrosion protection problems encountered during the New Guinea campaign. Methods for coating steel which afford either electrochemical or mechanical protection of nonferrous alloys.

7A-184. Adherence of Glass to Metal. Joseph A Pask. *Better Enameling*, v. 20, Nov. 1949, p. 6-7, 31.

Existing theories for this phenom-

Specify

ALOX 937

in the preparation of preservative lubricants used in

Low Temperature Operations

● Alox 937 is used in various types of preservative lubricants and retains its excellent lubricating qualities at very low temperatures. Liquid at room temperature and soluble in napthenic oils and oils used in the preparation of greases. It is recommended for use in preservative lubricants for use in firearms, instruments, ordnance equipment, woodworking tools and metalworking tools. It preserves iron and steel from corrosion and is effective even when applied in a thin, almost invisible "dry" coating.

Write for Technical Literature

ALOX CORPORATION
3946 BUFFALO AVENUE
NIAGARA FALLS, NEW YORK

enon, and their limitations. Proposes modified theory based on the older ones.

7A-185. Est-il possible de calculer la vie de peintures anti-rouille par l'examen de couches minces? (Is It Possible to Calculate the Life of Anti-Corrosion Paints by Investigation of Their Thin Films?) J. F. Bogtstra. *Métaux & Corrosion*, v. 25, June 1949, p. 157-162.

Relationship between thickness of the paint film and protective ability. Results indicate possibility of approximate calculation by use of coefficients for paint composition and corroding medium. Error is up to 20-25%.

7A-186. Les propriétés des métaux projetés au pistolet métalliseur à fil. (Properties of Metals Deposited by Means of a Wire-Fed Metallizing Gun.) J. Cauchetier and J. Grilliat. *Soudure et Techniques Connexes*, v. 3, July-Aug. 1949, p. 175-178.

Metals used in the experimental investigations (aluminum, copper, brass, bronze, and steel) possess specific properties quite different from those of the same metals in bulk form. This is due to the fact that spray-deposited metals have a stratified structure, slight porosity, and contain a certain amount of oxides.

7A-187. Décapants pour le brasage. (Pickling Agents for Brazing.) *Zeitschrift für Schweisstechnik; Journal de la Soudure*, v. 3, Mar. 1949, p. 52.

Composition of different pickling agents successfully used in soft and hard brazing in Switzerland. Applications.

7A-188. Electrochemical Method for Determining Anti-Corrosive Properties of Lacquer Films. (In Russian.) M. M. Gol'dberg and N. D. Tomashov. *Zavodskaya Laboratoriya* (Factory Laboratory), v. 15, Aug. 1949, p. 951-955.

New method based on use of a lacquered iron cathode and a plain zinc anode in 3% KCl solution. This method makes possible rapid determination of the influence of pigment layer on retardation of the cathodic process, which is directly related to the protective properties of a given coating. A special method for measuring the voltage of several pairs of electrodes without breaking the circuit.

7A-189. Natürliche und synthetische hochpolymere Stoffe als Korrosionsschutz. (Natural and Synthetic High-Polymers as Corrosion Resistant Materials.) St. Reiner. *Kautschuk und Gummi*, v. 1, July 1948, p. 177-181.

Types of coatings, methods of coating, and their adhesive and chemical properties (especially resistance to corrosive agents).

7A-190. (Book) The Science of Wrinkle Finish. W. A. Waldie. Research Press, Inc., 137 N. Perry St., Dayton, Ohio. $5.00.

Origin and characteristics of the process; special pattern formulations and techniques for applications. Intended primarily as a production man's guide. Majority of topics relate to specific techniques of application, ingredients, and processing and equipment.

7A-191. (Book) Metal Finishing Guidebook-Directory. Ed. 18. 468 pages. 1949. Finishing Publications, Inc., 11 W. 42nd St., New York 18, N. Y. $2.00.

Practical information on electroplating, cleaning, polishing, buffing, and related subjects. Finishing plant engineering, including layout, heating methods for plating solutions, and automatic controls. Includes a directory of suppliers and manufacturers of equipment and materials and a list of trade names.

7B—Ferrous

7B-219. Paints for Enclosed Structural Members in Steel Housing Construction. H. A. Pray and R. S. Peoples. *Iron Age*, v. 164, Oct. 20, 1949, p. 63-70.

See abstract of *American Iron and Steel Institute, Preprint*, 1949, item 7B-110, 1949.

7B-220. Phosphate Treating of Transformer Radiators at Allis-Chalmers Plant. *Industrial Heating*, v. 16, Oct. 1949, p. 1836.

7B-221. Cleaning and Phosphating Tractor Parts in One Operation. L. Williams. *Iron Age*, v. 164, Oct. 27, 1949, p. 66-68.

One-stage operation in which tractor parts are cleaned and phosphate coated.

7B-222. Chromizing Process as Developed and Used by Diffusion Alloys, Limited, of London. Charles A. Naugle. *Technical Data Digest*, v. 14, Nov. 1, 1949, p. 13-19.

Procedure, equipment, and results. Concludes that the process is commercially feasible and superior to the German process. Two other diffusion processes developed by the same company: "Sichromal" for simultaneous diffusion of Si, Cr, and Al into steel surfaces; and the "Hypoeutectoid" controlled carburizing process.

7B-223. Automatic Finishing of Water Heaters. Gilbert C. Close. *Industrial Finishing*, v. 25, Oct. 1949, p. 12-14, 17-18, 21-22.

Procedures and equipment.

7B-224. Abrasive Blasting Prepares Pipe Surfaces for Coating. J. F. Farrell. *Petroleum Engineer*, v. 21, Oct. 1949, p. D34-D36.

Methods and equipment.

7B-225. Handling Emery Dust in Saw Glazing. Clyde S. Cassels. *Iron Age*, v. 164, Nov. 3, 1949, p. 94-95.

Equipment and procedures for emery polishing of saw blades and for handling the dust.

7B-226. Operation and Maintenance of Spray Pickling Equipment. H. C. Ellinger. *Finish*, v. 6, Nov. 1949, p. 27-28, 70.

Operating data and practical suggestions based on three years of operation.

7B-227. Grit Blasting Sheet Steel Parts. A. E. Raeuber and E. D. Ploetz. *Finish*, v. 6, Nov. 1949, p. 25-26, 39.

See abstract from *Better Enameling*, item 7B-212, 1949.

7B-228. Review of Titanium Enamel Development and Its General Properties. Donald R. Goetchius. *Enamelist*, v. 26, Fall 1949, p. 3-6.

17 references.

7B-229. Effective Use of Vinyl Coatings in Control of Oil Tank Corrosion. W. J. Clayton. *Pipe Line News*, v. 21, Nov. 1949, p. 36-37.

Effects of plasticizer type and relationship of tide-range tests to sour-crude tank protection.

7B-230. A Study of Primers for Ferrous Metals in an Atmospheric Exposure. Fifth Report. *American Paint Journal* (Convention Daily), v. 34, Nov. 3, 1949, p. 14-16, 18-20, 25-28; **Atmospheric Exposure of Primers for Ferrous Surfaces.** *Paint, Oil and Chemical Review*, v. 112, Nov. 10, 1949, p. 96-104.

Tables give results of 1⅓, 1⅝, and 2½ yrs. Massachusetts outdoor exposure of a long series of primer compositions and systems.

7B-231. Variety, Volume, Versatility Characterize the Porcelain Enameling Operations at Independence Stove & Furnace Co. *Better Enameling*, v. 20, Nov. 1949, p. 8-15.

7B-232. Trouble Shootin'. John L. McLaughlin. *Better Enameling*, v. 20, Nov. 1949, p. 16.

Causes and remedies for porcelain-enamel defects known as pitty or dimpling, and waterline.

7C—Nonferrous

7C-40. Finishing Automotive Die Cast Parts. Herbert Chase. *Iron Age*, v. 164, Nov. 3, 1949, p. 89-91.

How high production rates for finishing Zn-alloy die-cast automotive parts are maintained through the use of tumbling and blasting equipment to remove flash and burrs, while a conveyerized automatic unit is utilized for dichromating parts to inhibit corrosion.

7D—Light Metals

7D-61. Can You Use Chemical Methods in Finishing Aluminum? *Steel*, v. 125, Oct. 31, 1949, p. 53-56, 58, 60.

Wide variety of protective and decorative finishes which can be produced economically by strictly chemical processes. Surface conversion coatings, frosted finishes, diffuse reflector finishes, various types of etched surfaces, chemically produced oxide coatings, and a method for producing bright chemical polish on aluminum by dipping.

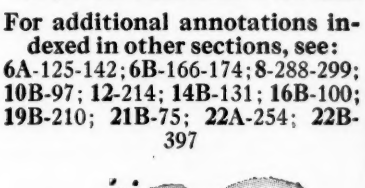
7D-62. Application of Dyestuffs to Anodized Aluminium. V. F. Henley. *Light Metals*, v. 12, Oct. 1949, p. 536-542.

Coloring of anodic films on Al and its alloys using organic dyestuffs. Methods of treating such films prior to coloring and methods of after-treatment of colored anodic films.

7D-63. Importance de l'effet d'amortissement chimique dans le traitement des alliages de magnesium. (Importance of the Effect of Chemical Inhibition During Surface Treatment of Magnesium Alloys.) L. F. Le Brocq and H. G. Cole. *Métaux & Corrosion*, v. 24, July-Aug. 1949, p. 177-191.

Use of inhibitors during chemical surface treatment. Relationship of inhibitive effect of various materials on pH and composition of the bath.

For additional annotations indexed in other sections, see:
6A-125-142; 6B-166-174; 8-288-299; 10B-97; 12-214; 14B-131; 16B-100; 19B-210; 21B-75; 22A-254; 22B-397



8
ELECTRODEPOSITION and ELECTROFINISHING

8-286. Metallurgy and Electroplating. Harold J. Read. *Mineral Industries* (Pennsylvania State College), v. 19, Oct. 1949, p. 1, 3-4.

Unsolved practical and fundamental problems in electroplating requiring metallurgical research for their solution.

8-287. Electrolytic Polishing in Cyanide Solutions. *Electroplating and Metal Finishing*, v. 3, Oct. 1949, p. 48-51.

Process applicable to the treatment of Ag, Cu, Cd, alloys consisting of these metals, brass, bronze, Zn, and

Ni-Ag. The applied voltage is caused to fluctuate between certain limits instead of being held constant.

8-288. Plating Zinc and Zinc Alloys. *Electroplating and Metal Finishing*, v. 3, Oct. 1949, p. 54-56.

Pretreatment, degreasing, and neutralization. Copper, brass, Ag, Ni, Cr, and bright Zn plating.

8-289. Une nouvelle méthode pour la mesure de l'adhésivité des revêtements électrolytiques. (A New Method for Measurement of the Adhesivity of Electrodeposits.) M. Bonnemay. *Journal des Recherches du Centre National de la Recherche Scientifique*, no. 7, 1948, p. 156-160.

After a critical study of three well-known methods, it was concluded that none are entirely satisfactory. A new mechanical method was developed.

8-290. Das anodische Polieren. (Anodic Polishing.) Kurt Schmidt and Otto Kahl. *Zeitschrift des vereines Deutscher Ingenieure*, v. 91, Aug. 15, 1949, p. 389-390.

Electrolytes, currents, temperatures, and other conditions required for anodizing iron and steel. The differences between "luster" and "smoothness". 22 ref.

8-291. Die elektrolytische Abscheidung von Metallen aus komplexe Ionen enthaltenden Lösungen. (The Electrolytic Precipitation of Metals From Solutions Containing Complex Ions.) E. Raub and B. Wullhorst. *Archiv für Metallkunde*, v. 3, Sept. 1949, p. 323-328.

Previously abstracted from *Zeitschrift für Elektrochemie und angewandte Physikalische Chemie.* See item 8-234, 1949.

8-292. Influence of Current Density, Distance Between Electrodes, and Temperature on Ratio of Actual Product to Theoretical During Electrolysis of Cadmium Chloride. (In Russian.) G. A. Abramov and A. A. Kostyukov. *Zhurnal Prikladnoi Khimii* (Journal of Applied Chemistry), v. 22, June 1949, p. 578-585.

The equations relating above ratio to current density, distance between electrodes, and to temperature are applicable to electrolysis of cadmium chloride. 14 ref.

8-293. Protective-Decorative Nickel Plating Without Subsequent Polishing. (In Russian.) N. T. Kudryavtsev, O. M. Korolkova, and V. V. Fedurkin. *Zhurnal Prikladnoi Khimii* (Journal of Applied Chemistry), v. 22, June 1949, p. 586-591.

It was found that the distinguishing characteristic of the electrolyte for bright nickel plating is the presence of a small amount of potassium or sodium salts of naphthalene disulfonic acid. Other components have the same purpose as in standard nickel plating. This electrolyte operates at a high pH (6.3) and in a wide temperature interval (20-45° C.) and range of current density. Optimum method of plating. 10 ref.

8-294. Conditions for Electrodeposition of a Mn-Ni Alloy. (In Russian.) D. N. Gritsan and N. S. Tsvetkov. *Zhurnal Prikladnoi Khimii* (Journal of Applied Chemistry), v. 22, June 1949, p. 600-604.

Possibility of simultaneous deposition of Mn and Ni from sulfate solutions in the presence of ammonium salts. Influence of salt concentration, cathode current density, and pH on content of Mn in the electrodeposit.

8-295. Estimating Plating Time. Tyler G. Hicks. *American Machinist*, v. 93, Nov. 3, 1949, p. 235.

Nomographic chart is clarified by two numerical examples.

8-296. The Chemistry of Copper-Zinc Alloy Plating Baths. A. Kenneth Graham. *Plating*, v. 36, Nov. 1949, p. 1120-1126.

First of a series of articles on brass and "bronze" plating, which will include discussions of both high and low-speed plating. The chemistry of the Cu-Zn baths determines their rather unusual behavior in the plant. Novel recommendations for preparation of new baths.

8-297. Effect of Impurities and Purification of Electroplating Solutions. I. Nickel Solutions. 3. Purification of Solutions, Methods of Operations, and Testing of Deposits. D. T. Ewing, Robert J. Rominski, and William M. King. *Plating*, v. 36, Nov. 1949, p. 1137, 1140-1145.

Appearance, adhesion, salt-fog corrosion resistance, ductility, and hardness. Throwing power and current efficiency of the plating baths. Practical methods for evaluation of physical properties.

8-298. How To Avoid Electroplating Equipment Failures Due to Stray Currents. E. C. Reichard. *Products Finishing*, v. 14, Nov. 1949, p. 26-28, 30.

Recommendations.

8-299. Aluminum: Its Surface Preparation and Finishing. Part II. Electroplating on Aluminum. E. R. Yarham. *Products Finishing*, v. 14, Nov. 1949, p. 40, 42, 44, 48, 50, 52, 54, 56, 58, 60, 62, 64, 66.

Recommended procedures including preliminary surface preparation.

8-300. Barrel Plating to Specification. A. W. Wallbank. *Journal of Electrodepositors' Technical Society*, v. 24, 1949, p. 181-193. (Preprint.)

Lack of understanding of surface area of load and resulting low current densities. Thickness determination, barrel design, plant layout, process control, costs, and prices.

8-301. French Electroplating Practice; The Modern Plant of the Japy Works at Arcueil (Seine). *Metal Industry*, v. 75, Oct. 14, 1949, p. 330-332.

8-302. Estimating Plating Finish Weight. Tyler G. Hicks. *American Machinist*, v. 93, Nov. 17, 1949, p. 139.

Use of nomograph is illustrated by numerical examples.

8-303. The Structure of Electrodeposits; A Review of the Present State of Knowledge. J. J. Dale. *Metal Industry*, v. 75, Oct. 21, 1949, p. 355-357; Nov. 4, 1949, p. 394-395.

10 references.

8-304. Potential of Nickel in Solutions of Nickel Electrolytes. (In Russian.) B. V. Drozdov. *Zhurnal Prikladnoi Khimii* (Journal of Applied Chemistry), v. 22, July 1949, p. 716-723.

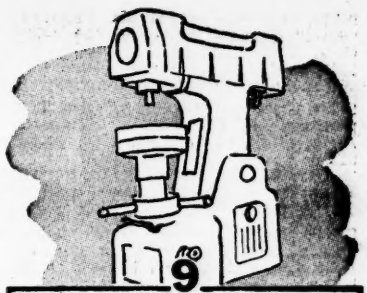
Potentials of pure active and inactive nickel in Ni salt solutions were measured. Influence of individual components. Data are charted for Cu and Mn additions. Influence of pH on potential was determined.

For additional annotations indexed in other sections, see:

2B-287; 2C-81; 7A-183-191; 11-360; 15-74

Abstracts of 918 articles on ELECTROPLATING

Published during the past five years are available to you. *Complete your set of five volumes of A.S.M. Review of Metal Literature now.* Order from American Society for Metals, 7301 Euclid Ave., Cleveland 3, Ohio.



9 PHYSICAL and MECHANICAL TESTING

9-286. Strain Measurements on Rotating Parts. R. E. Gorton and R. W. Pratt. *SAE Quarterly Transactions*, v. 3, Oct. 1949, p. 540-556.

Previously abstracted from condensed version in *SAE Journal.* See item 9-118, 1949.

9-287. Problems of Aircraft Life Evaluation. Joel M. Jacobson. *SAE Quarterly Transactions*, v. 3, Oct. 1949, p. 616-629; discussion, p. 629-633.

Fatigue information as it applies to life expectancy calculations for aircraft. The number of factors and the lack of data, as well as of a definite theory, make it impossible to do more than make a reasonable guess of life expectancy. Repeated load tests still appear to be the most satisfactory method of ensuring safe life expectancy.

9-288. Tests Bars; Towards Standardization for Copper-Base Alloys. V. Kondic. *Metal Industry*, v. 75, Oct. 7, 1949, p. 283-286.

The present status of test-bar practice; unsolved problems in casting and using test bars, and in interpreting test-bar results. 16 ref.

9-289. A Microhardness Tester for Use With an Inverted Microscope. G. H. Townend. *Journal of Scientific Instruments and of Physics in Industry*, v. 26, Sept. 1949, p. 295-296.

Some general aspects of microhardness-tester design and an instrument compatible with the conclusions reached. An example of its use.

9-290. The Mode of Fracture at the Neck of a Tensile Specimen. W. I. Pumphrey. *Proceedings of the Physical Society*, v. 62, sec. B, Oct. 1, 1949, p. 647-651.

Bridgman has shown that in a cylindrical specimen deforming plastically under longitudinal tension, tensile stress at the neck of the specimen is greatest on the longitudinal axis and least at the periphery of the specimen. Fracture therefore commences at the center and extends to the periphery. "Double-cup" fractures encountered during tensile testing of a number of alloys at elevated temperatures were accounted for in this way. Metallurgical factors which govern occurrence of this type of fracture are examined.

9-291. Hardness Testing. Reginald S. Bruce. *Edgar Allen News*, v. 28, Sept. 1949, p. 373-376; Oct. 1949, p. 410-411.

Equipment and procedures.

9-292. Die Entwicklung der Setzdehnungsmesser an der Materialprüfungsanstalt Stuttgart. (Development of an Extensometer at the Materials Testing Institute in Stuttgart.) S. Schwaigerer. *Archiv für Metallkunde*, v. 3, Sept. 1949, p. 307-308.

Instrument developed to measure internal stresses in the vicinity of welds. It can also be used to measure extension under stress.

9-293. Quick-Selection Chart for "SR-4" Strain-Gage-Type Pick-Ups. G. L. Rogers. *Instruments*, v. 22, Oct. 1949, p. 912.

Includes numerical example.

9-294. Testing Materials at High Temperature. F. G. Tatnall. *Mechanical Engineering*, v. 71, Nov. 1949, p. 906-910.

Short-time stress-strain, stress-rupture, creep, relaxation, and fatigue tests.

9-295. Some Transverse Tests on Meehanite Iron Beams. Oliver Smalley. *Iron Age*, v. 164, Nov. 10, 1949, p. 83-86.

A series of tests utilizing a strain-gage technique. The material appears to obey Hooke's law in bending up to about 30% of the ultimate load, and at moderate loads, modulus of elasticity is the same in tension and compression.

9-296. Some Experiments on the Bursting of Spherical Rotors by Centrifugal Forces. J. W. Beams. *Proceedings of the Society for Experimental Stress Analysis*, v. 7, no. 1, 1949, p. 1-6.

Steel rotors of various sizes are spun to speeds where explosion occurs. The stresses developed are calculated by Chree's method. Application of technique to other problems.

9-297. Electric Resistance Changes of Fine Wires During Elastic and Plastic Strains. E. W. Kammer and T. E. Pardue. *Proceedings of the Society for Experimental Stress Analysis*, v. 7, no. 1, 1949, p. 7-20.

Investigated for Fe, Ni, Pt, and 15 alloys used in the construction of bonded-wire strain gages. Description of apparatus. 13 ref.

9-298. BL-310. "Strain Analyzer". Dean Christian. *Proceedings of the Society for Experimental Stress Analysis*, v. 7, no. 1, 1949, p. 21-29.

Problems involved in the design of a complete strain-gage recording system capable of making instantaneous recordings of static strains, and of dynamic strains up to 120 cycles per sec. The instrument and its characteristics, use, and the resulting chart record. Includes circuit diagrams.

9-299. Tests of a Railroad Bridge With a Mechanical Oscillator. E. J. Ruble. *Proceedings of the Society for Experimental Stress Analysis*, v. 7, no. 1, 1949, p. 31-44.

Tests were conducted on a truss span in order to determine the separate effect of unbalanced forces in locomotive driving wheels and to study the damping of the structure. Design and construction of the oscillator used to excite motion.

9-300. A Biaxial Stress Machine for the Determination of Plastic Stress-Strain Relations. Joseph Marin. *Proceedings of the Society for Experimental Stress Analysis*, v. 7, no. 1, 1949, p. 71-82.

Strains were measured in the plastic range by specially designed electric SR-4 clip gages. Yield strength, ultimate strength, ductility, and plastic stress-strain relations were determined for Alcoa 24S-T tubular specimens subjected to biaxial tensile stresses.

9-301. Fatigue Life of Rail Webs in Service. C. J. Code and A. E. F. Billstein. *Proceedings of the Society for Experimental Stress Analysis*, v. 7, no. 1, 1949, p. 103-116.

Rail failure. Field measurement of stresses and laboratory fatigue studies. Redesign.

9-302. Large-Scale Torsional Fatigue Testing of Marine Shafting. S. F. Dorey. *Institution of Mechanical Engineers, Proceedings*, v. 159, War Emergency Issue No. 46, 1948, p. 399-406; discussion, p. 407-415.

Design and construction of a new testing machine of the resonance type capable of generating a reversed harmonic torque of up to $\pm 3 \times 10^6$ lb.-in. in a stationary test shaft, at a frequency of approximately 2,500 vibrations per min. A specially developed electronic method of speed control is capable of regulating the nominal stress in the specimen to within 1%. Results of a number of fatigue tests on 9¾-in. diam. mild steel shafts, and also on "Meehanite" cast-iron specimens 6 in. in diam.

9-303. Fatigue Tests With Stress Cycles of Varying Amplitude. G. Wallgren. *Aeronautical Research Institute of Sweden* (Stockholm), Report No. 28, 1949, 34 pages.

Tests were made with elements of 24S-T and 75S-T Alclad and of Cr-Mo steel, which consisted of unnotched sheet specimens, specimens notched by drilled holes, and riveted joints. Loads were varied according to two different load spectra representing stresses due to gust and maneuvering loads of aircraft wings. Validity of the cumulative damage theory which states that failure will occur when the sum of all part damages equals unity. 14 ref.

9-304. Influence of Size of Test Specimen on Notch Sensitivity of Steels and Light Alloys. (In Russian.) S. E. Belyaev. *Zavodskaya Laboratoriya* (Factory Laboratory), v. 15, July 1949, p. 821-828.

Influences of length and diameter of test specimen, of temperature of annealing, and of degree of curvature, if any, on accuracy of determination of yield strength by tensile test. Comparative data for different steels and alloys are tabulated and charted.

9-305. Investigation of Hardness by an Indentation Method. (In Russian.) I. L. Mirkin and S. I. Novak. *Zavodskaya Laboratoriya* (Factory Laboratory), v. 15, July 1949, p. 835-841.

Use of irregular loading in hardness tests. The relationship of diameter of indentation to load, for all the metals tested, obeyed an exponential law beginning with loads at which elastic deformation of the ball and the material no longer play an essential role. Limits of applicability of steel balls and balls of hard alloys. Test data on several Armco irons, a high-chromium alloy, and duralumin.

9-306. Long-Time Hardness Tests. (In Russian.) A. P. Gulyaev and E. F. Trusova. *Zavodskaya Laboratoriya* (Factory Laboratory), v. 15, July 1949, p. 842-844.

Method using a Brinell tester, in which the ball is pressed into the specimen at high temperatures for an extended period of time (30 sec., 10 min., 30 min., etc.). Method was applied to study of the influence of alloying elements (0.5, 1.0, 2.0, 3.0, and 5% Zn or Mg) on the properties of solid solutions of Al-Zn or Al-Mg. Inapplicability of the method to determination of heat resistance.

9-307. Apparatus for Determination of Wear of Shaft Bearings. (In Russian.) A. S. Livshits and M. I. Shchepak. *Zavodskaya Laboratoriya* (Factory Laboratory), v. 15, July 1949, p. 876-878.

Simple apparatus, including a recording pen.

9-308. Creep-Testing Machine. (In Russian.) Yu. S. Gintsburg and N. D. Zaitsev. *Zavodskaya Laboratoriya* (Factory Laboratory), v. 15, July 1949, p. 878-882.

Newly developed creep-test machine designed for mass screening tests of alloys and for high-temperature tests in creep, continued to rupture. This machine tests alloys designed for use at temperatures up to 1100° C. Maximum tensile load is 750 Kg. Limits of creep may be determined at deformations of the order of 10% per hour.

9-309. Photoelasticity Procedure Is Simplified With Diffused-Light Polariscope and Prepolished Materials. August J. Durelli and Rex L. Lake. *Machine Design*, v. 21, Nov. 1949, p. 137-141.

Theoretically, the photo-elastic method of stress analysis is capable of producing precise results by simple means. In practice, however, attainment of precision has been possible only with the aid of a costly optical setup and extremely complicated techniques. A diffused-light polariscope and some simplified techniques.

9-310. Hardness Testing With Precision Indenter. *Machine Design*, v. 21, Nov. 1949, p. 146-147.

A commercially available instrument.

9-311. Perforated Cover Plates for Steel Columns. *Technical News Bulletin* (National Bureau of Standards), v. 33, Nov. 1949, p. 133-134.

Methods used for study of mechanical properties of perforated-steel cover plates for bridge columns, utilizing full-scale models.

9-312. Der Einfluss einer tiefenabhängigen Spannungsverteilung auf die röntgenographische Spannungsmessung. (Effect of a Depth-Dependent Stress Distribution on X-Ray Stress Measurements.) Eugen Osswald. *Zeitschrift für Metallkunde*, v. 39, Sept. 1948, p. 279-288.

Equations applicable to the case in which magnitude of stress varies with distance from the surface. Inhomogeneously distributed stresses determined by different methods are correlated with respective positions in the stress field. Method of converting apparent stresses to actual stresses.

9-313. Method of Fatigue Testing of Metals Using a Three-Roll Machine. (In Russian.) M. M. Khrushchov and M. A. Babichev. *Zavodskaya Laboratoriya* (Factory Laboratory), v. 15, Aug. 1949, p. 962-967.

The method is particularly recommended for bimetallic test specimens, in which a nonferrous more plastic metal forms a thin layer on the inside surface of a steel ring. Method of determining endurance limit.

9-314. Influence of Method of Notching on Impact-Strength Characteristics. (In Russian.) S. K. Maksimov. *Zavodskaya Laboratoriya* (Factory Laboratory), v. 15, Aug. 1949, p. 967-971.

Impact strength is greatest when the notch is drilled, intermediate when it is formed by abrasion, and least when cut. Data are tabulated and charted for 0.17-0.30% C steels.

9-315. Method of Determination of Fatigue Strength Under High Stresses. (In Russian.) S. L. Zhukov. *Zavodskaya Laboratoriya* (Factory Laboratory), v. 15, Aug. 1949, p. 971-976.

Two Shenk machines are used for fatigue testing in bending and torsion. Both machines permit determination of fatigue strength at stresses near the endurance limit. Typical data for steel.

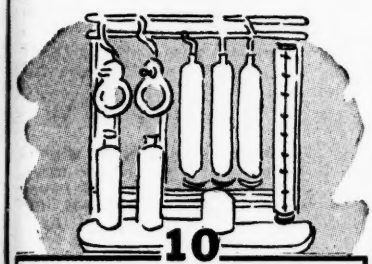
9-316. Centrifugal Method for Testing Metals and Alloys at High Temperatures. (In Russian.) M. E. Rabinovich. *Zavodskaya Laboratoriya* (Factory Laboratory), v. 15, Aug. 1949, p. 988-993.

Investigation of heat resistance of alloys of the Al-Cu-Mn-Zn system at 300° C. Influence of Zn addition to the ternary system.

9-317. Testing Gun Steel and Other Alloys and Metals for Resistance to Surface Cracking. E. Ingerson. *Transactions of the American Institute of*

Mining and Metallurgical Engineers, v. 176, 1948, p. 477-489; discussion, p. 489.
Previously abstracted from *Metals Technology*. See item 9-138, 1947.

For additional annotations indexed in other sections, see: 3A-223; 3B-244; 5A-61; 19B-217; 24A-144; 24D-22



10 ANALYSIS

10A—General

10A-141. Die photometrische Bestimmung des Molybdäns mittels Thioglykolsäure. (Photometric Determination of Molybdenum by Means of Thioglycolic Acid.) Fritz Richter. *Chemische Technik*, v. 1, July 1949, p. 31-34.
Method, including example of application to Mo in steel.

10A-142. The Analytical Uses of Dithiocarbamido-Hydrazine. J. Gupta and B. Chakrabartty. *Journal of Scientific & Industrial Research*, v. 8B, Aug. 1949, p. 133-137.
Use in qualitative and quantitative determination of a number of common metallic cations.

10A-143. The Use of Surface Active Agents to Prevent "Precipitate Crawling" and to Speed Filtration in Gravimetric Determinations. (In English.) J. N. Ospenson. *Acta Chemica Scandinavica*, v. 3, no. 6, 1949, p. 630-638.
Certain surface-active agents are capable of preventing "crawling", thus speeding filtration, and maintaining accuracy in the determination of Ni as Ni-dimethylglyoxime. The agents are classified according to the types given by McCutcheon.

10A-144. Reversible Indicators for Use in Potassium Bromate Titrations. (In English.) R. Belcher. *Analytica Chimica Acta*, v. 3, Sept. 1949, p. 578-588.
The reversible indicators α-naphthoflavone, p-ethoxychrysoidine, fuchsin, and apomorphine are satisfactory, but α-naphthoflavone gives the sharpest end-points. Titration of trivalent antimony and determination of aluminum. 11 ref.

10A-145. Laboratories That Make Fire Assays, Analyses, and Tests on Ores, Minerals, Metals, and Other Inorganic Substances. Bertha R. Klahold. *U. S. Bureau of Mines*, Information Circular 7523, Oct. 1949, 55 pages.
Various testing techniques. Data on laboratories, their addresses, and special services.

10A-146. Increase of Stability of the Activated Alternating-Current Arc Under Spark Conditions for Spectro-Analytical Purposes. (In Russian.) I. S. Abramson and O. B. Fal'kova. *Zhurnal Tekhnicheskoi Fiziki* (Journal of Technical Physics), v. 19, May 1949, p. 611-615.
Three circuits for improving stability.

10A-147. Rapid Method for Determination of Calcium Carbide in Slag. (In Russian.) A. G. Bogdanchenko. *Zavodskaya Laboratoriya* (Factory Laboratory), v. 15, July 1949, p. 851-853.
Method based on solution of slag in dilute acid and combustion of the liberated acetylene. Four variations of the apparatus. Typical data.

10A-148. Apparatus for Selection of Samples of Metals for Microchemical Analysis. (In Russian.) E. S. Berkovich and A. D. Kuritsyna. *Zavodskaya Laboratoriya* (Factory Laboratory), v. 15, July 1949, p. 868-869.
Applicable for qualitative and, possibly, quantitative determination of chemical nature of phases, especially inclusions, in an alloy. Apparatus for obtaining microsamples is a modified microhardness-testing device, having a special spindle with a diamond drill on the bottom. Method of obtaining sample.

10A-149. Investigation of the Effect of Spark Formation and Influence of Third Elements During Spectral Analysis. Part I. (In Russian.) L. N. Filimonov. *Zavodskaya Laboratoriya* (Factory Laboratory), v. 15, Aug. 1949, p. 919-936.
Investigated for different alloys in oxidizing and reducing atmospheres. Effect of different factors; technique of investigation. 25 ref.

10A-150. Spectroscopic Method for Determination of Silicon and Chromium in Certain Ferro-Alloys. (In Russian.) P. D. Korzh and A. V. Kozlova. *Zavodskaya Laboratoriya* (Factory Laboratory), v. 15, Aug. 1949, p. 937-939.
Method using comparison of densities in unknown and standard specimens. Results of typical determinations.

10A-151. Spectroscopic Analysis of Ferrosilicon. (In Russian.) I. M. Veselovskaya. *Zavodskaya Laboratoriya* (Factory Laboratory), v. 15, Aug. 1949, p. 940-944.
Use of briquettes. Method of briquette preparation and influence of various factors on results of analysis.

10A-152. Determination of Tungsten in Ferrotungsten High-Speed Toolsteels on the Basis of Specific Gravity. (In Russian.) S. I. Malov. *Zavodskaya Laboratoriya* (Factory Laboratory), v. 15, Aug. 1949, p. 997-998.
Method is said to surpass the chemical method in accuracy.

10B—Ferrous

10B-83. Determination of Nitrogen in Steel. John L. Hague, Rolf A. Paulson, and Harry A. Bright. *Journal of Research of the National Bureau of Standards*, v. 43, Sept. 1949, p. 201-207.
Rapid semimicro method. Nitrogen is put into solution as ammonium sulfate by treatment of the sample with H_2SO_4 by steam distillation from an alkaline solution. The distillate is collected in boric acid solution, and the nitrogen determined by titration with 0.01 *N* acid. Effect of some common alloying elements on acid solubility of nitrogen compounds in steel. 30 ref.

10B-84. Distribution of Columbium in Ingot Steel. (In Russian.) G. N. Oiks, Yu M. Maksimov, and A. M. Dymov. *Doklady Akademii Nauk SSSR* (Reports of the Academy of Sciences of the USSR), new ser., v. 66, June 1, 1949, p. 661-662.
Investigated by gravimetric determination of Cb contents of shavings obtained by drilling an ingot at different points. The P and S contents were determined simultaneously.

10B-85. The Direct Reading Analysis of 18-8 Stainless Steels. M. F. Hasler. *Iron Age*, v. 164, Nov. 3, 1949, p. 96-99.
Spectrographic analysis is generally considered unsuitable for contents of elements greater than 5%. Development of the multiplier-phototube as a light-measuring device makes possible improvements in precision and speed of analysis and removes the contents limitation. Successful application of the technique to stainless steels.

10B-86. Geiger Counter Speeds Analysis of Alloy Steels. *Product Engineering*, v. 20, Nov. 1949, p. 154.
Apparatus and technique.

10B-87. Determination of Metallic Iron Contained in Bloom and Sponge Iron by Means of a Ferric Chloride Solution. Saburo Kitahara. *Journal of the Scientific Research Institute*, v. 43, Apr. 1949, p. 1-27.
Use of ferric and of mercuric chlorides for solution of metallic iron. Solubility determinations were made on various iron compounds likely to be present in sponge iron and bloom. Relative merits of the two methods. 42 ref.

10B-88. Photocolorimetric Analysis of Stainless Steel. (In Russian.) K. A. Shisterman and O. A. Yakovleva. *Zavodskaya Laboratoriya* (Factory Laboratory), v. 15, July 1949, p. 782-785.
Describes method for stainless steel containing up to 5% Mo in the presence of 16-19% Cr and 12-14% Ni. Course of analysis is described for determination of Si, Ni, Ti, and Mo. Time required is 30-40 min.

10B-89. Microchemical Determination of Carbon in Ordinary and Alloy Steels. (In Russian.) A. I. Glazova and E. I. Nikitina. *Zavodskaya Laboratoriya* (Factory Laboratory), v. 15, July 1949, p. 847-848.
Method based on combustion of carbon to the dioxide and determination of the latter by use of liquid air. Conditions of testing and typical data.

10B-90. New Semi-Micro Method for Determination of Sulfur in Cast Irons. (In Russian.) A. T. Chernyi and K. V. Podoinikova. *Zavodskaya Laboratoriya* (Factory Laboratory), v. 15, July 1949, p. 849.
Cast iron is broken into tiny particles which are sintered in a glazed porcelain tube with a mixture of oxalic acid and calcium filings. Time of test is 12-15 min. Applicability of method is confirmed on test specimens of specular and foundry-pig cast iron containing 0.023-0.284% S.

10B-91. Spectroscopic Analysis of Basic Openhearth Slags. (In Russian.) O. I. Nikitina. *Zavodskaya Laboratoriya* (Factory Laboratory), v. 15, July 1949, p. 855-857.
Lines in the 2700-3200 A region
Lines in the 2700-3200 Å region were used. Specific conditions for determination of CaO, SiO_2, MnO, and FeO are indicated.

10B-92. Spectrographic Determination of Phosphorus in Cast Iron. (In Russian.) M. S. Alpatov. *Zavodskaya Laboratoriya* (Factory Laboratory), v. 15, July 1949, p. 857-858.
Recommended procedure and typical data.

10B-93. Einfache Methoden zur Unterscheidung von Stählen. (Simple Methods for Identification of Steels.) W. Küntscher and H. Kilger. *Chemische Technik*, v. 1, Sept. 1949, p. 93-97.
Qualitative spot-test methods.

10B-94. The Determination of Chromium in Cast Iron and Steel. T. S. Harrison and H. Storr. *Analyst*, v. 74, Sept. 1949, p. 502-504.
Application of modified bromate oxidation process to the determination of Cr in a variety of ferrous alloys. The analyses may also be completed volumetrically, the end-point being very definite.

10B-95. Spektrograficke stanoveni hliniku a tatanu v ocelich. (Spectrographic Determination of Aluminum and Titanium in Steels.) Josef Kuba. *Hutnické Listy*, v. 4, Aug. 1949, p. 237-241.

Methods developed in a Czechoslovakian steel-mill laboratory.

10B-96. Rapid Method of Determination of Iron Oxide in Agglomerates. (In Russian.) N. Z. Plotkin, Yu. I. Usatenko, and P. A. Bulakhova. *Zavodskaya Laboratoriya* (Factory Laboratory), v. 15, Aug. 1949, p. 999-1000.

New method based on ability of ferrous oxide to be oxidized during annealing. It requires only 7-10 min. Typical results.

10B-97. Methods for Chemical Control of the Surface Preparation of Steel Wire. (In Russian.) I. I. Vainshenker and Z. I. Granik. *Zavodskaya Laboratoriya* (Factory Laboratory), v. 15, Aug. 1949, p. 1006-1007.

Analytical methods used in control of the pickling bath.

10B-98. Local Spectrographic Analysis of Low-Alloy Steel. (In Russian.) W. G. Isaev. *Zavodskaya Laboratoriya* (Factory Laboratory), v. 15, Aug. 1949, p. 1010-1011.

Electric circuit that limits surface destruction not only in depth but also to the smallest possible area.

10B-99. Sampling and Analysis of Steel for Hydrogen. G. Derge, W. Peifer, and J. H. Richards. *Transactions of the American Institute of Mining and Metallurgical Engineers*, v. 176, 1948, p. 219-246; discussion, p. 246-247.

Previously abstracted from *Metals Technology*. See item 10b-43, 1948.

10B-100. Apparatus for the Hot-Extraction Analysis for Hydrogen in Steel. C. E. Sims and G. A. Moore. *Transactions of the American Institute of Mining and Metallurgical Engineers*, v. 176, 1948, p. 248-257; discussion, p. 257-259.

Previously abstracted from *Metals Technology*. See item 10b-44, 1948.

10C—Nonferrous

10C-152. Determination of Uranium in Ores. Modified Mercury Cathode-Cupferron Method. F. T. Rabbitts. *Canadian Mining Journal*, v. 70, Oct. 1949, p. 84-86.

Details of procedure. Includes as appendix a reprint of "Mercury Cathode Cell for Rapid Electrolysis", from *Analytical Chemistry*. See item 10A-28, 1948.

10C-153. Spectrochemical Determination of Hafnium-Zirconium Ratios. Cyrus Feldman. *Analytical Chemistry*, v. 21, Oct. 1949, p. 1211-1215.

Previously abstracted from *U. S. Atomic Energy Commission*, AECD-2342. See item 10C-67, 1949.

10C-154. Determination of Microgram Amounts of Thorium; A Colorimetric Method. P. F. Thomason, M. A. Perry, and W. M. Byerly. *Analytical Chemistry*, v. 21, Oct. 1949, p. 1239-1241.

Method for the range 5-80 micrograms. Uranium and the rare earths do not interfere in amounts less than 1000 micrograms and interference from iron can be lessened by reduction to the ferrous state. 10 ref.

10C-155. Iodometric Semimicrodetermination of Thallium in Ores and Flue Dusts. Claude W. Sill and Heber E. Peterson. *Analytical Chemistry*, v. 21, Oct. 1949, p. 1268-1273.

10C-156. Organic Onium Compounds as Inorganic Analytical Reagents; Detection of Bismuth and Cobalt. Herbert A. Potratz and Jerome M. Rosen. *Analytical Chemistry*, v. 21, Oct. 1949, p. 1276-1279.

21 references.

10C-157. Determination of Tin in Manganese Bronzes. George Norwitz, Thomas F. Boyd, and Freda Bachtiger. *Analytical Chemistry*, v. 21, Oct. 1949, p. 1291.

Procedure in which Sn is quantitatively precipitated as metastannic acid. Interference of Fe is eliminated by simple procedural modifications.

10C-158. Absorptiometric Determination of Uranium. A. A. Smales and E. Furby. *Nature*, v. 164, Oct. 1, 1949, p. 579.

Effect of bicarbonate on the H_2O_2 method.

10C-159. Polarography of Quinoline Derivatives. Part IV. Amperometric Titration of Copper and Zinc With Quinaldinic Acid. John T. Stock. *Journal of the Chemical Society*, July 1949, p. 1793-1797.

Amperometric titration with quinaldinic acid of Cu, Zn, and Cd in concentrations less than 3×10^{-3} M. was studied. Cu and Zn are precipitated slowly in the cold, but titration is practicable at 60°. Under certain conditions Cu and Zn in the same solution may be successfully titrated, and Cu may be determined in the presence of Cd. Attempts to determine Cd either directly or by back-titration were unsuccessful.

10C-160. Use of Complexones in Chemical Analysis. (In English.) R. Pribil. *Collection of Czechoslovak Chemical Communications*, v. 14, no. 6, 1949, p. 320-330.

Various derivatives of imino diacetic acid and of phenyliminodiacetic acid have a remarkable ability to bind many cations in such a way that it is impossible to prove their presence by current analytical reactions. Because of their complex-forming character, they have been called "complexones". Determinations of Co, Mn, Cr, Mg and other metals.

10C-161. Un nuovo sistema di analisi spettrografica dei bronzi. (A New System for Spectrographic Analysis of Bronzes.) R. Berta and A. Palisca. *La Metallurgia Italiana*, v. 41, May-June 1949, p. 128-134.

Improved system for quantitative determination of Sn, Zn, Pb, and other elements in Cu-base alloys, especially cast bronzes. A counter electrode of very pure bismuth is used. Typical results show high accuracy.

10C-162. Sur la Thermogravimétrie des précipités analytiques. XXVII. Dosage du Thorium. (Thermogravimetric Analysis of Analytical Precipitates. Determination of Thorium.) Thérèse Dupuis and Clément Duval. **XXVIII. Dosage du Manganèse.** (Determination of Manganese.) Thérèse Dupuis, Jean Besson, and Clément Duval. *Analytical Chimica Acta*, v. 3, Sept. 1949, p. 589-605.

Weight-change curves obtained on drying the various compounds of Th and Mn which may be precipitated in gravimetric analysis. Recommendations as to the most suitable compounds and drying temperatures. 58 ref.

10C-163. The Reduction of Antimonial Tin Solutions With Metallic Nickel and Cobalt. H. Holness. *Analyst*, v. 74, Aug. 1949, p. 457-461; discussion, p. 462.

Antimonial solutions containing 1.1% Sn were reduced by Ni powder and small coprecipitations of Sn were observed. When sheet nickel was substituted for powder, only a trace of retained Sn was noted. Experiments using metallic Co in place of Ni showed it to be less satisfactory.

10C-164. Application of Ion-Exchange Materials in Analytical Chemistry. IV. Determination of Sulfur, Phosphorus, and Arsenic in Nickel and Copper. (In Russian.) Yu. Yu. Lur'e and N. A. Filippova. *Zavodskaya Laboratoriya* (Factory Laboratory), v. 15, July 1949, p. 771-779.

Conditions for absorption of Cu and Ni from weakly acidic solutions, thus permitting determination of S, P, and As in these metals by well-known methods. Two variations of the colorimetric determination of As and P.

10C-165. Determination of Molybdenum in Ferromolybdenum With the Aid of a Cation-Exchange Material. (In Russian.) Yu. I. Usatenko and O. V. Datsenko. *Zavodskaya Laboratoriya* (Factory Laboratory), v. 15, July 1949, p. 779-781.

New method using sulfocarbonate. Influence of different factors, such as acidity.

10C-166. A Precise Volumetric Method for the Determination of Uranium in Uranium Oxides. W. Simon, I. Asbury, V. E. Flanders. *U. S. Atomic Energy Commission*, AECD 2652, Aug. 27, 1948, 18 pages.

A procedure was developed which has a precision of 0.05% of the uranium present. Procedure differs from standard ones only in quality of equipment and in method of dissolving samples.

10C-167. The Use of Ether Extraction in the Determination of Uranium. T. R. Scott. *Analyst*, v. 74, Sept. 1949, p. 486-491.

An extraction procedure suitable for general application.

10C-168. The Determination of Zirconium in Minerals and Refractories by the Tannin Method. H. Holness and R. W. Kear. *Analyst*, v. 74, Sept. 1949, p. 505-507.

Modified procedure.

10C-169. Separation of Hafnium and Zirconium by a Fractional Distillational Procedure. D. N. Gruen and J. J. Katz. *U. S. Atomic Energy Commission*, AECD 2584, Mar. 29, 1949, 4 pages.

Procedure at atmospheric pressure using volatile complexes formed by reaction of Zr and $HfCl_4$ with $POCl_3$.

10C-170. Micro-séparation du manganèse par le réactif carbamique de Delépine. (Microseparation of Manganese by Means of Delepine's Carbamic Reagent.) Georges Sag. *Bulletin de la Société Chimique de France*, Jan.-Feb. 1949, p. 30-31.

Simple, rapid and accurate method for elimination of Ce, Co, Cr, ferrous ions, and Ni during colorimetric determination of Mn in metals.

10C-171. Prispevek k identifikaci ruznych druhu tvrdych kovu. (A Contribution to the Identification of Various Kinds of Hard Metals.) Miroslav Petrdlík. *Hutnické Listy*, v. 4, June 1949, p. 165-168.

Use of colorimetric or electroanalytical methods for Ti and Co carbides

10C-172. Method of Determination of Cadmium in Low Concentrations. (In Russian.) Yu. A. Chernikhov and B. M. Dobkina. *Zavodskaya Laboratoriya* (Factory Laboratory), v. 15, Aug. 1949, p. 906-909.

Contrary to the literature, Cd carbamate is soluble in organic solvents and possesses high stability in an aqueous medium. Possibility of quantitative extraction of Cd in carbamate form by an organic solvent from aqueous media of pH 1.5-9.0 is demonstrated. Final determination is performed by the dithizone method.

10C-173. Use of Solid Immersed Electrodes for Polarographic Determination of Silver. (In Russian.) Yu. S. Lyalikov and R. I. Glazer. *Zavodskaya Laboratoriya* (Factory Laboratory), v. 15, Aug. 1949, p. 909-911.

Tabulated and graphed data.

10C-174. Electrolytic Separation of Copper From Small Amounts of Cadmium. (In Russian.) P. N. Kovalenko. *Zavodskaya Laboratoriya* (Factory Laboratory), v. 15, Aug. 1949, p. 915-918.

Applying an oxidized aluminum cathode for electrolytic Cu determi-

nation and its separation from additions. Electrodeposition of large amounts of Cu is possible at pH's of 1.0-2.5 and temperatures of 20-80° C. Amount deposited depends on these factors and also on character of surface treatment of the Al cathode.

10C-175. Spectrographic Analysis of Nickel Alloys. (In Russian.) K. A. Sykhenko and O. I. Mladentseva. *Zavodskaya Laboratoriya* (Factory Laboratory), v. 15, Aug. 1949, p. 946-950.

Methods for analyzing Ni alloys for Cr, Ti, Fe, Al, Cu, Si, and Mn. Applicability of different light sources. Influence of supporting-electrode material, size of spark gap, self-inductive capacity, and time of heating the electrodes. Best pairs of spectral lines for analysis are indicated.

10D—Light Metals

10D-34. Die potentiometrische Schnellbestimmung von Mangan in Leichtmetall-Legierungen. (A Rapid Potentiometric Method for Determining the Manganese Content of Light-Metal Alloys.) G. Maassen. *Metall*, v. 3, Aug. 1949, p. 257-260.

Details of method and typical results.

10D-35. Schnellerkennung von Leichtmetall-Legierungen. (Rapid Analysis of Light-Metal Alloys.) M. Niessner. *Archiv für Metallkunde*, v. 3, Sept. 1949, p. 305-306.

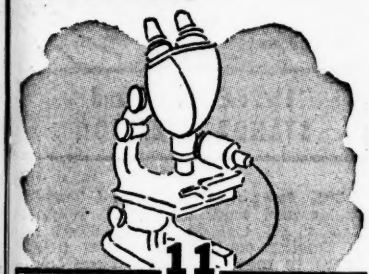
Spot and filter tests and e.m.f. determination of composition.

10D-36. Über eine Methode der Bestimmung von Wasserstoff, insbesondere in Magnesium. (A Method of Determining Hydrogen, Especially in Magnesium.) Franz Sauerwald. *Zeitschrift für anorganische Chemie*, v. 256, May 1948, p. 217-225.

Chlorine is passed into the molten sample, the resulting HCl is burned with oxygen and over CuO, and the water thus formed is weighed. Control tests were made to determine the suitability of the method.

10D-37. Determination of Small Amounts of Iron in Metallic Magnesium. (In Russian.) I. V. Rozenberg. *Zavodskaya Laboratoriya* (Factory Laboratory), v. 15, Aug. 1949, p. 944-945.

Spectrochemical method for determining concentrations of 0.001-0.01% Fe in metallic Mg.



11 APPARATUS, INSTRUMENTS and METHODS

11-335. Kornfärbungs- und Schraffurätzung von Aluminium-Kupfer-Magnesium-Legierungen. (Grain Coloration and Line Etching of Aluminum-Copper-Magnesium Alloys.) Hans Kostron. *Zeitschrift für Metallkunde*, v. 39, Nov. 1948, p. 333-342.

Thoroughly describes above types of etching. 21 ref.

11-336. Some Experiences in the Application of the Electron Microscope to the Study of Steels. F. W. Cuckow and J. Trotter. *Proceedings of the Physical Society*, v. 62, sec. B, June 1, 1949, p. 360-365.

Steel specimens were examined with light and electron microscopes. The micrographs are critically examined and compared. There is an obvious gain in picture sharpness in the electron micrographs. However, interpretation of the micrographs from plastic replicas in terms of geometry of the specimen surfaces is more straightforward.

11-337. A Unit-Magnification Optical System for the Attainment of Long Working Distances in Microscopy. J. Dyston. *Proceedings of the Physical Society*, v. 62, sec. B, Sept. 1, 1949, p. 565-575.

A system giving unit magnification and used in conjunction with a conventional microscope was selected as suitable. Aberrations of such a system and means of correcting them. Typical results.

11-338. A Geiger Counter Spectrometer for the Measurement of Debye-Scherrer Line Shapes. W. H. Hall, U. W. Arndt and R. A. Smith. *Proceedings of the Physical Society*, v. 62, sec. A, Oct. 1, 1949, p. 631-638.

Monochromatic radiation is used, and diffracted-beam intensity is recorded by a Geiger counter. Intensity of the X-ray source is monitored continuously, and errors due to variations in its output are automatically compensated. Accuracy and resolution obtainable are demonstrated by some typical experimental results. 14 ref.

11-339. Preparation of Micrographs of Metals and Alloys; Including Recommended Practice for Photography as Applied to Metallography. *Foundry*, v. 77, Nov. 1949, p. 115-116.

Proposed revised tentative ASTM methods.

11-340. A High Temperature Precision X-Ray Camera. Some Measurements of the Thermal Coefficients of Expansion of Beryllium. Paul Gordon. *Journal of Applied Physics*, v. 20, Oct. 1949, p. 908-917.

Previously abstracted from *U. S. Atomic Energy Commission*, AECD-2426. See item 11-79, 1949.

11-341. Electron Microscope and Diffraction Study of Metal Crystal Textures by Means of Thin Sections. R. D. Heidenreich. *Journal of Applied Physics*, v. 20, Oct. 1949, p. 993-1010.

Bethe's dynamical theory of electron diffraction in crystals is developed using the approximation of nearly free electrons and Brillouin zones. Concluded that the kinematic theory is inadequate for interpreting electron images of crystalline films. An electrolytic method for preparing thin-metal sections for electron microscopy and diffraction; application to cold worked Al and an Al-Cu alloy. Suggested that nucleation and growth reorientation are responsible for self-recovery in cold-worked metals. Formation of $CuAl_2$ precipitate particles. 18 ref.

11-342. Characteristics of Metallographic Polishing Powders. E. C. Rollason, E. Sharratt, and R. R. Roberts. *Journal of the Iron and Steel Institute*, v. 162, July 1949, p. 265-270.

Physical properties of powders used for metallographic polishing of mild steel specimens were studied. The most essential factor is that the particles shall be plate-shaped. Polishing depends largely on friction between the powder and the specimen, and not on cutting action. Use of gamma alumina and alpha alumina. 14 ref.

11-343. Monochromateur-focalisateur logarithmique: Application à l'étude de la texture et des déformations des cristaux. (Logarithmic Monochromator-Focuser: Application to Study of the

BURRELL
BOX and MUFFLE
FURNACES

HIGH TEMPERATURE "UNIT-PACKAGE" ELECTRIC BOX and MUFFLE FURNACES for melting, sintering, heat treating, ignitions, etc.

Write for Bulletins 315 and 515.

BURRELL 1942 FIFTH AVE PITTSBURGH 19 PENNSYLVANIA

BURRELL
TUBE FURNACE

HIGH TEMPERATURE "UNIT-PACKAGE" ELECTRIC TUBE FURNACES for determination of carbon or sulfur by combustion and for experimental or production purposes.

Write for bulletin 310.

BURRELL 1942 FIFTH AVE PITTSBURGH 19 PENNSYLVANIA

Structure and Deformation of Crystals.) Jean Barraud. *Comptes Rendus* (France), v. 229, Aug. 1, 1949, p. 378-380.

Optical setup of instrument. Application to a sample of mica.

11-344. Handlicher Schichtdicken-Messer Hoher Messgenauigkeit. (Handy and Highly Accurate Layer-Thickness Meter.) R. Berthold. *Zeitschrift des Vereines Deutscher Ingenieure,* v. 91, Sept. 15, 1949, p. 476-478.

The proposed instrument for measuring the thicknesses of non-ferromagnetic layers or ferromagnetic materials consists of pole pieces of non-permanent-magnetic but highly permeable material. It can measure thicknesses up to 1 mm. with an average accuracy of 10%.

11-345. Die Messung der mechanischen Dämpfung der Metalle. (Measuring the Mechanical Damping of Metals.) Cord Petersen. *Archiv für technisches Messen,* Sept. 1949, p. T74-T76. (6 p.)

Methods and commonly used apparatus. 23 ref.

11-346. The Accuracy of Interatomic Distances Obtained in Electron Diffraction Investigations of Molecular Structures. (In English.) D. W. J. Cruickshank and H. Viervoll. *Acta Chemica Scandinavica,* v. 3, no. 6, 1949, p. 560-568.

Methods of correcting systematic errors of finite integration in the radial distribution functions of electron diffraction. A method for estimating standard deviations in interatomic distances, due to random experimental errors, approximation errors in calculation, and any inaccuracies in correction for finite integration. 10 ref.

11-347. Determination of Crystal Orientation of Hexagonal Metal Single Crystals by the Light-Figure Method. (In Japanese.) Miko Yamamoto and Jiro Watanabe. *Nippon Kinzoku Gakkai-Si* (Journal of the Japan Institute of Metals), v. 13, Apr. 1949, p. 9-14.

Procedure and accuracy explained for the case of zinc single crystals of cylindrical-rod shape.

11-348. An Evaluation of Radioactive Isotopes in Metallurgy. C. E. Birchenall and W. O. Philbrook. *Iron Age,* v. 164, Nov. 10, 1949, p. 77-82, 174.

Advantages and limitations of radioactive tracers in metallurgical research and development. Characteristics of various radioisotopes and experiences obtained in investigating potential applications. Handling and exposure problems.

11-349. Optical Diffraction Patterns Produced by Bubble Rafts. J. Dyson. *Proceedings of the Royal Society,* ser. A, v. 199, Oct. 7, 1949, p. 130-139.

Method of obtaining diffraction patterns, analogous to X-ray and electron diffraction patterns, from photographs of assemblies of $\frac{1}{16}$-in. metal balls. The experiments have two potential uses. In the first place, it may be possible to obtain some insight into relationships between observed phenomena in X-ray and electron diffraction and crystal imperfections which cause them. In the second place, the method of inspection of the raft by means of light contained in a restricted portion of the diffraction pattern offers a ready method of investigating effects produced by dislocations.

11-350. Die materialtechnische Prüfung von zahnärztlichen Materialien. (Technical Testing of Dental Materials.) W. Rimathé. *Schweizer Archiv für angewandte Wissenschaft und Technik,* v. 15, Sept. 1949, p. 270-273.

German and foreign work concerned with both metallic and nonmetallic materials.

11-351. Preparation of Metallographic Sections and Development of Microstructure of Metal-Ceramic Solid Alloys. (In Russian.) I. N. Chaporova. *Zavodskaya Laboratoriya* (Factory Laboratory), v. 15, July 1949, p. 799-805.

"Metal-ceramic solid alloys" consist basically of tungsten and titanium carbides plus smaller amounts of other metallic carbides. Metallographic technique; etching compositions and conditions.

11-352. Method of Investigation of the Structure of Complex Alloys Using the Electron Microscope. (In Russian.) D. S. Shraiber and E. K. Molchanova. *Zavodskaya Laboratoriya* (Factory Laboratory), v. 15, July 1949, p. 806-810.

Special technique and typical results.

11-353. Accuracy of Determination of Limits of Solubility in Binary Metallic Systems. (In Russian.) I. L. Rogel'berg and S. Kh. Kipnis. *Zavodskaya Laboratoriya* (Factory Laboratory), v. 15, July 1949, p. 814-817.

Results of a thorough analysis of the various factors involved. 12 ref.

11-354. Study of Microplasticity of Commercial Alloys by Means of a "Microscreen". (In Russian.) T. I. Gudkova, N. E. Karskii, and G. I. Soboiev. *Zavodskaya Laboratoriya* (Factory Laboratory), v. 15, July 1949, p. 818-821.

Method of drawing a microscreen, for the purpose of graduating in hundredths of a millimeter. Applicability of such a microscreen.

11-355. Interpretation of "Ultra-Fine" Structures of X-Ray Absorption Spectra of Solids. (In Russian.) A. I. Kostarev. *Zhurnal Eksperimental'noi i Teoreticheskoi Fiziki* (Journal of Experimental and Theoretical Physics), v. 19, May 1949, p. 413-420.

Details of methods and application to Cu and α-Fe. Influence of type of crystalline lattice on character of fine structure of X-ray absorption spectra.

11-356. A Photo-Grid Technique for Sheet Metal Elongation Measurements. *Technical News Bulletin* (National Bureau of Standards), v. 33, Nov. 1949, p. 125-127.

Technique developed at National Bureau of Standards.

11-357. A Small Laboratory Arc Furnace. G. Hutt and A. Schneider. *Engineers' Digest,* v. 10, Oct. 1949, p. 354. Translated and condensed from Archives of the Board of Trade, German Division.

Furnace for temperatures above 2000° C., and for vacuum or inert-gas operation. It permits approximately quantitative collection of sublimates, and direct resistance heating of the melt.

11-358. Metallurgical Achievements of the Electron Microscope; A Review of the Literature to the End of 1948. G. A. Geach. *Metallurgia,* v. 40, Oct. 1949, p. 319-326.

Includes typical electron micrographs. 111 ref.

11-359. Dosage, par diffraction des rayons X, des corps ou des phases cristallisées dans leurs mélanges. (Determination of Substances or Crystallized Phases in Mixtures by Means of X-Ray Diffraction.) G. W. Brindley. *Bulletin de la Société Chimique de France,* Jan.-Feb. 1949, p. D59-D63.

The method, advantages and disadvantages. Possible large errors in determination and ways to avoid them. Typical results. 10 ref.

11-360. La structure des surfaces de zinc polies électrolytiquement. (Surface Structure of Electropolished Zinc.) H. Raether. *Métaux & Corrosion,* v. 24, June 1949, p. 145-148.

Method using electron diffraction and measurement of dissociation potential. Conditions of experimental investigation.

11-361. Graphical Study of Metallurgical Equilibria. M. J. N. Pourbaix and C. M. Rorive-Bouté. *Faraday Society,* "The Physical Chemistry of Process Metallurgy", Discussion No. 4, 1948, p. 139-154; discussion, p. 217-244. Translated from the French.

Previously abstracted from *Faraday Society Transactions,* Preprint, Sept. 1948. See item 11-254, 1948.

11-362. A Method for Determining the Origin of Surface Defects in Rolled Steel Products. C. L. Meyette and V. E. Elliott. *Transactions of the American Institute of Mining and Metallurgical Engineers,* v. 176, 1948, p. 201-215; discussion, p. 216-218.

Previously abstracted from *Metals Technology.* See item 11-179, 1948.

11-363. X-Ray Determination of Retained Austenite by Integrated Intensities. B. L. Averbach and M. Cohen. *Transactions of the American Institute of Mining and Metallurgical Engineers,* v. 176, 1948, p. 401-414; discussion, p. 414-415.

Previously abstracted from *Metals Technology.* See item 11-31, 1948.

11-364. Correlation of Optical and Electron Microscopy. J. S. Bryner. *Transactions of the American Institute of Mining and Metallurgical Engineers,* v. 180, 1949, p. 356-362.

Previously abstracted from *Metals Technology.* See item 11-178, 1948.

For additional annotations indexed in other sections, see:
8-289; 14A-161

Precision
OPTICAL AND MEASURING INSTRUMENTS
A survey of our products sent on request
THE GAERTNER SCIENTIFIC CORPORATION
1229 Wrightwood Ave. -:- Chicago 14, U.S.A.

12 INSPECTION and STANDARDIZATION

12-202. Inspecting Forged Turbine Blades and Buckets. R. F. Wagner. *Steel,* v. 125, Oct. 24, 1949, p. 66-67.

Quality control procedures necessary to meet extremely close tolerances.

12-203. Aircraft Firms Coordinate Metals Specifications. *Western Metals,* v. 7, Oct. 1949, p. 39.

Program on the West Coast. Firms involved and items in question.

12-204. Observations sur le controle des pièces résistantes moulées en alliages légers et ultra légers. (Observations on Inspection of Cast Structural Light-Alloy Parts for Defects.) M. R. Chion. *Fonderie,* Aug. 1949, p. 1687-1701.

Results of investigation indicate that the most important factor in any test method is the duplication of service conditions during testing.

12-205. Tool Standardization at Thompson Products. W. D. Angst.

Tool & Die Journal, v. 15, Nov. 1949, p. 47-52.

12-206. A New Concept of Surface Measurement. 1. Present Methods of Surface Finish Control and Development of Geometric Surface Finish Standards. Arthur F. Underwood and Roy P. Trowbridge. **2. The Calibration and Use of Master Roughness Standards.** C. R. Lewis. *Tool Engineer*, v. 23, Nov. 1949, p. 17-24.

Development of ruled surface-finish standards by General Motors. Originals are made on 2x3-in. blocks of silver-clad steel plates with gold. The surface is polished to an average roughness of one microinch. Rulings are made on a special machine with a diamond stylus. Duplicates are made by an electroforming process. Method of calibration and use of Nelson's taper sectioning method which increases magnification in one direction by as much as 25 to 1.

12-207. Handy Quality Control for the Machine Shop. Clifford W. Kennedy. *Modern Machine Shop*, v. 22, Nov. 1949, p. 126-128, 130, 132, 134, 136, 138-139.

The standard-deviation, frequency-distribution, quality-control technique.

12-208. Xeroradiography; A Basic Development in X-Ray Testing. *Iron Age*, v. 164, Nov. 10, 1949, p. 91. Based on paper by R. C. McMaster and R. M. Schaffert.

All-electric method for obtaining permanent, low-cost X-ray images developed at Battelle Memorial Institute. It eliminates film and chemical processing and hence the usual time delay between exposure and examination. Contrast sensitivity exceeds the 2% required for inspection of aircraft parts. The process possesses unusual local-contrast sensitivity and definition exceeds 200 lines to the inch.

12-209. Inspection Methods of New and Used Oil Country Tubular Goods. M. W. Newman. *Non-Destructive Testing*, v. 8, Summer 1949, p. 9-13.

12-210. Aircraft Non-Destructive Testing. William C. Hilt. *Non-Destructive Testing*, v. 8, Summer 1949, p. 14-18.

Methods for the above with emphasis on Magnaflux and Zyglo.

12-211. Railroad Non-Destructive Testing. Arthur S. Pedrick. *Non-Destructive Testing*, v. 8, Summer 1949, p. 19-24.

The various methods, their advantages, limitations, and applicabilities.

12-212. Petroleum Refinery Non-Destructive Testing. G. C. Vergne. *Non-Destructive Testing*, v. 8, Summer 1949, p. 25-32.

Various methods, indicating advantages, limitations, and applicabilities.

12-213. Oil Tool Manufacturing and Non-Destructive Testing. Frank R. Drahos. *Non-Destructive Testing*, v. 8, Summer 1949, p. 33-35.

Magnetic-particle inspection, mobile Magnaflux testing, radiography, and strain-gage analysis.

12-214. Product Quality Standards in the Porcelain Enamel Industry. G. H. Spencer-Strong. *Standards World*, v. 1, Autumn 1949, p. 35-42.

Progress in development of standards.

12-215. Steel Products Manual. Sec. 6. Carbon Steel Plates and Rolled Floor Plates. Sec. 11. Carbon Steel Sheets. Sec. 13. Cold Rolled Carbon Steel Strip. *American Iron and Steel Institute*, Sept. 1949, 122, 155, and 78 pages respectively.

Metallurgical aspects, manufacturing practices, quality and chemical requirements, and handling methods.

12-216. Radiography—A Refinery Corrosion Inspection Tool. J. H. Stewart. *Petroleum Processing*, v. 4, Nov. 1949, p. 1211-1214.

Use by some Gulf Coast refiners for determining corrosion, wall thickness, and other conditions of vessels, piping, etc.

12-217. Correct Manufacture and Use Determine Lasting Gage Block Accuracy. H. J. Chamberland. *Steel*, v. 125, Nov. 14, 1949, p. 116, 118.

Recommended procedures.

12-218. Ultrasonics: A Brief Survey. John H. Jupe. *Electronic Engineering*, v. 21, Nov. 1949, p. 422-424.

Metallurgical and nonmetallurgical applications. 126 ref.

12-219. Notes on the Use of Radon in Engineering Radiography. V. E. Pullin. *Engineer*, v. 188, Oct. 21, 1949, p. 452-453.

Availability, protection, technique, and equipment.

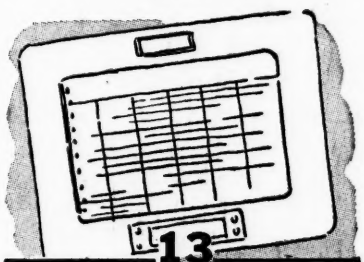
12-220. Magnetinduktive Stahlprüfung. (Magneto-Inductive Testing of Steel.) Kurt Matthaes. *Zeitschrift für Metallkunde*, v. 39, Sept. 1948, p. 257-272.

Instrument and its use in detecting defects and sorting steel tubes and bars.

12-221. (Book) Taper Calculation and Inspection. 74 pages. 1949. Machinery Publishing Co., Ltd., National House, West St., Brighton, England. (Agent: Industrial Press, 148 Lafayette St., New York 13, N. Y.) 3s. 6d.

Fundamental formulas for calculating tapers; universal taper measuring gages and inspection gage-blocks, as well as methods of gaging taper fit assemblies; angular tolerances of taper plug and ring gages and their effects. Tables facilitate calculation.

For additional annotations indexed in other sections, see:
3B-242; 10A-145; 13-65; 14A-161; 18B-207; 19A-261



TEMPERATURE MEASUREMENT and CONTROL

13-63. A Mechanism for Controlling Several Furnaces Independently With One Temperature Regulator. H. H. Macey. *Journal of Scientific Instruments and of Physics in Industry*, v. 26, Sept. 1949, p. 312-314.

Simple mechanical device.

13-64. Some Basic Concepts of Thermoelectric Pyrometry: Peltier and Thomson Effects, Laws of Intermediate Temperatures and Metals. C. C. Roberts and C. A. Vogelsang. *Industrial Heating*, v. 16, Oct. 1949, p. 1754, 1756, 1900, 1902, 1904, 1906, 1908.

13-65. Control and Inspection of Heat Treated Parts. Part II. (Concluded.) Howard E. Boyer. *Steel Processing*, v. 35, Oct. 1949, p. 537-541, 562.

Miscellaneous procedures and equipment for temperature-control and inspection.

13-66. Interpolation Formulas for Platinum Resistance Thermometers and Platinum-Rhodium vs. Platinum Thermocouples. (In Russian.) B. I. Pilipchuk. *Zhurnal Tekhnicheskoi Fiziki* (Journal of Technical Physics), v. 19, June 1949, p. 667-672.

Formulas for calibration.

13-67. Some Observations on the Behaviour of Platinum/Platinum-Rhodium Thermocouples at High Temperatures. M. K. McQuillan. *Journal of Scientific Instruments and of Physics in Industry*, v. 26, Oct. 1949, p. 329-331.

Effect of heating at high temperatures on the Pt-Rh element of Pt thermocouples. In air, more Pt than Rh is lost by preferential oxidation, and in vacuo, by volatilization. Very little metal is lost on heating in hydrogen. An explanation of those effects. Effect of heating Pt wires in a reducing atmosphere in the presence of refractory materials other than those containing silicon.

13-68. Thermocouple for the Measurement of Steel Bath Temperatures. V. G. Gruzin. *Engineers' Digest*, v. 10, Oct. 1949, p. 344. Translated and condensed.

Previously abstracted from *Zavodskaya Laboratoriya* (Factory Laboratory). See item 13-9, 1949.

13-69. Elektronen-gesteuerter Schnellthermostat. (Electron-Controlled Rapid-Acting Thermostat.) H. Unstätter. *Chemie-Ingenieur-Technik*, v. 21, Sept. 1949, p. 342-345.

The theory of thermostats. A new and improved type. Graphs show the degree of constancy in the temperatures of furnaces controlled by this type of thermostat.

13-70. Determination of Cutting Temperature. (In Russian.) N. I. Leonov. *Stanki i Instrument* (Machine Tools and Equipment), v. 20, May 1949, p. 22-23.

Characteristics of two types of thermocouples commonly used for the above. Advantages and disadvantages of each.

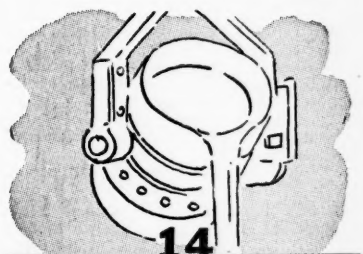
13-71. Notes on the Experimental Technique of Some Physico-Chemical Measurements Between 1000° and 2000° C. J. A. Kitchener and J. O'M. Bockris. *Faraday Society*, "The Physical Chemistry of Process Metallurgy", Discussion No. 4, 1948, p. 91-100; discussion, p. 108-126.

Previously abstracted from *Faraday Society Transactions*, Preprint. See item 13-43, 1948.

13-72. Temperatures in the Open-Hearth Furnace. Robert B. Sosman. *Transactions of the American Institute of Mining and Metallurgical Engineers*, v. 176, 1948, p. 15-51.

Previously abstracted from *Metals Technology*. See item 13-40, 1948.

For additional annotations indexed in other sections, see:
3B-230



FOUNDRY PRACTICE

14A—General

14A-158. Automatic Molding Machine. *Heating and Ventilating*, v. 46, Oct. 1949, p. 74-75.

Self-contained molding machine performing all the functions and operations required to produce molds, from introduction of the sand ingre-

dients through completion of multiple molds stacked six high ready for pouring.

14A-159. Plastic Foundry Matchplates. Franz Schumacher. *Modern Plastics*, v. 27, Nov. 1949, p. 95-97, 100.

Methods of production and advantages.

14A-160. Centrifugal Tubular Castings for Industry. Earl M. Anger. *Iron and Steel Engineer*, v. 26, Oct. 1949, p. 90-94; discussion, p. 94-95.

Advantages and present and potential applications. Value of the oriented macrostructure for many applications.

14A-161. Réalisation d'un dispositif de meulage dans le vide par meule à grande vitesse, avec controle simultané des surfaces par diffraction électronique. (Development of an Apparatus for High-Speed Vacuum Casting With Simultaneous Control of Surface Quality by Electron Diffraction.) R. Courtel and R. Leger. *Journal des Recherches du Centre National de la Recherche Scientifique*, no. 7, 1948, p. 161-167.

Device designed for the study of cast surfaces during their solidification under high vacuum. Typical results for mild steel.

14A-162. Auswertung der Siebanalysen von Form- und Kernsanden. (Evaluation of the Sieve Analyses of Welding and Core Sands.) Wilhelm Bültmann. *Die Neue Giesserei*, v. 36 (new ser., v. 2), Sept. 1949, p. 264-266.

Graphical method.

14A-163. Ueber die Festigkeit von Kernen in hoher Temperatur. (The Strength of Cores at Elevated Temperatures.) Franz Roll. *Die neue Giesserei*, v. 36 (new ser., v. 2), Sept. 1949, p. 266-269.

Experimentally determined strengths of cores of different compositions. Nonshrinking cores and effect of the allotropic transformation of quartz.

14A-164. An "Ideal" Foundry: Plant, Equipment, and Process Machinery. W. A. Turner. *Metal Industry*, v. 75, Oct. 14, 1949, p. 337-341.

Such a foundry, combining all of the features considered "ideal" does not exist, but the recommendations are believed to be of value in planning and selection of new equipment.

14A-165. Work of the Lake & Elliot Foundry Technical Committee. L. W. Sanders, C. H. Kain, R. J. Hart, W. L. Hardy, and J. W. Gardom. *Foundry Trade Journal*, v. 87, Oct. 20, 1949, p. 481-490; Oct. 27, 1949, p. 513-518; discussion, p. 518-520, 527.

Monthly examination of statistics in an iron and steel foundry. Research on cast steel test-bars, and attempts made to establish a reliable and workable machinability test suitable for use by foundries. Development and use of coated molding sands and resin-bonded core sands.

14A-166. Notes on Core Blowing Practice. W. Fearfield. *Foundry Trade Journal*, v. 87, Oct. 20, 1949, p. 497-498; discussion, 499-502.

Selection of equipment and procedures.

14A-167. Apparatus for Determination of Fluidity and Rate of Flow of Molten Metal. (In Russian.) L. L. Kunin. *Zavodskaya Laboratoriya* (Factory Laboratory), v. 15, July 1949, p. 870-872.

Apparatus, which permits simultaneous determination of the length of time necessary for filling the mold and rate of flow of the molten metal. Details of the process.

14A-168. Research on Castings. I. Cooling and Solidification of Sand Castings. (In Japanese.) Goro Ohira. *Nippon Kinzoku Gakkai-Si* (Journal of the Japan Institute of Metals), v. 13, Jan. 1949, p. 40-44.

Investigated by determining temperature variations of the metal and the sand at various points throughout the assembly. Conclusions concerning heat transfer, cooling, and solidification mechanisms are summarized in English. An empirical formula for solidification time is introduced.

14A-169. Modern Practice in Investment Casting. Hiram Brown. *Foundry*, v. 77, Nov. 1949, p. 82-83, 205-210, 212.

Properties of pattern and investment materials. (To be continued.)

14A-170. The Thermal Properties and Chilling Power of Some Non-Metallic Mould Materials. R. W. Ruddle and A. L. Mincher. *Journal of the Institute of Metals*, v. 76, Sept. 1949, p. 43-90.

Brief mathematical treatment of the flow of heat in molds of low thermal conductivity. Experimental work was done to test the validity of the mathematical treatment, and determine the chilling powers of the materials examined. Cylinders were cast in molds of synthetic sand (green and dry), naturally bonded sand (green and dry), bonded magnesite, bonded silicon carbide, and plaster. Different alloys were used to examine the influence of solidification temperature on heat flow in the different molds. Approximate figures were derived for temperature diffusivity, apparent thermal conductivity, heat diffusivity, and "mold constant". These constants may be used to calculate solidification times of simple castings with fair accuracy. 29 ref.

14A-171. Dielectric Heating: Applications in the Foundry. J. Pound. *Metal Industry*, v. 75, Oct. 21, 1949, p. 351-353; Oct. 28, 1949, p. 379-381; Nov. 4, 1949, p. 399-400.

Fundamentals of dielectric heating; details of foundry processes involving its use; present and potential applications.

14B—Ferrous

14B-125. Standards Must Be Observed in Cupola Operations. R. H. Olmsted. *Foundry*, v. 77, Nov. 1949, p. 78-79, 200, 203-204.

Recommended procedures developed as a result of an investigation conducted to determine the causes of habitual excessive burn-out of linings in certain areas of a large cupola.

14B-126. Develops New Type Unit for Desulphurizing Cupola Iron. Frank E. Bates. *Foundry*, v. 77, Nov. 1949, p. 88-91.

Equipment designed to simplify and make more effective the economical addition of soda ash to cupola iron. The process is intended not only to promote intimate contact between the molten metal and desulfurizing agent, but also to assist in slag separation.

14B-127. The British Team Reports on U. S. Steel Foundries. *Foundry*, v. 77, Nov. 1949, p. 92, 172, 174, 176, 178.

Excerpts from report of British Steel Founders' Productivity Team of 16 men who spent five weeks visiting steel foundries in the U. S.

14B-128. Steel Castings; A Review of Factors Affecting Surface Finish. P. R. Beeley. *Iron and Steel*, v. 22, Oct. 1949, p. 451-454.

Reactions with mold materials; metal penetration; effects of mold and core compositions, grain size, etc.; effects of mold coatings; other factors. 13 ref.

14B-129. Nodular Graphite; Producing Spheroidal Structures With Magnesium. C. K. Donoho. *Iron and Steel*, v. 22, Oct. 1949, p. 455-458.

See abstract from *American Foundryman*, item 14B-16, 1949.

14B-130. Gates and Risers; Removal by Abrasive Cut-off and by Band Saws. H. J. Chamberland. *Iron and Steel*, v. 22, Oct. 1949, p. 459-460.

Advantages and disadvantages of the two procedures. Comparative times for a series of typical stainless steel parts. The friction saw is faster in most cases.

14B-131. Light Castings for Vitreous Enamelling. H. McNair. *Foundry Trade Journal*, v. 87, Oct. 6, 1949, p. 433-439, 442.

Refers to iron castings of 1-50 lb. weight and thicknesses of ⅛–¼ in. Effect of metal composition, of cupola practice, of melting flux, and of molding sand. Worm marks or rat-tail defects, feeding systems, patterns and their care, design, rate of cooling, warping, and "boiling" during enameling.

14B-132. Sistema di formatura e di colata per una serie di grossi volani in ghisa. (Molding and Casting System for a Series of Large Cast-Iron Flywheels.) Fulvio Forti. *La Metallurgia Italiana*, v. 41, Mar.-Apr. 1949, p. 57-62.

Casting a series of wheels of 3 tons average weight. The standard system resulted in serious defects, so a modified pouring system was developed, which gave good results.

14B-133. Cenni sulla fabbricazione della ghisa sintetica al forno elettrico. (Notes on the Melting of Synthetic Cast Iron in the Electric Furnace.) Ermeneglido Zan. *La Metallurgia Italiana*, v. 41, May-June 1949, p. 144-148.

Melting of steel scrap carburized with coke and with scrap graphite electrodes. Efficiency obtained during the various carburizing periods and properties of the cast iron so obtained.

14B-134. Betriebserfahrungen mit einer Heisswind-Kupolofenanlage. (Plant Experiences With a Hot-Blast Cupola Furnace.) Otto Mattern. *Die neue Giesserei*, v. 36 (new ser., v. 2), Sept. 1949, p. 275-280.

Superiority of the hot-blast over the cold-blast cupola from the standpoint of economy and quality of melt.

14B-135. Centrifugal and Vacuum Investment Casting. E. F. Ross. *Steel*, v. 125, Nov. 7, 1949, p. 116-117, 144.

Used to produce intricate, close-tolerance parts from difficult-to-cast alloys. Plastic patterns, filling molds, and vacuum casting.

14B-136. Spheroidal-Graphite Cast Iron. W. W. Braidwood and A. D. Busby. *Nickel Bulletin*, v. 22, Aug.-Sept. 1949, p. 126-130.

Previously abstracted from *Foundry Trade Journal*. See item 14B-106, 1949.

14B-137. What's in a Name? *American Foundryman*, v. 16, Oct. 1949, p. 34-38; Nov. 1949, p. 44-46.

Proper terminology for the new type of iron known variously as nodular, spheroidal, globular, lump, etc. Contributors to opinion survey are J. E. Rehder, Gosta Vennerholm, Albert De Sy, A. P. Gagnebin, Charles K. Donoho, E. K. Smith, and Wm. W. Austin, Jr. (Oct. issue); and H. Morrogh, D. E. Krause, W. W. Levi, and J. C. H. Stearns (Nov. issue).

14B-138. Foundry Steel-Melting Conference; Discussion on Steelmaking Processes. *Metallurgia*, v. 40, Oct. 1949, p. 313-318.

Proceedings of conference held by the Steel Castings Div. of BISRA. Converter and furnace design, control of sulfur and phosphorus, oxygen enrichment, and refractories.

14B-139. Colloidal Phenomena in Metals. XII. Explanation of the Phenomenon of Crust Formation During Casting of Metals on the Basis of the Electrochemical Theory of Slags. (In Russian.) Yu. A. Klyachko and L. L.

Kunin. *Zhurnal Prikladnoi Khimii* (Journal of Applied Chemistry), v. 22, July 1949, p. 707-715.

Laboratory investigation. Casting of iron in a sand mold is followed by formation of an intermediate phase, which represents the product of reaction of metal oxides with oxides of the mold mixture. On the basis of the ionic theory of slags and chemical analysis of experimental slags, molecular weight of the reaction product was determined and confirmed by X-ray investigation. 15 ref.

14C—Nonferrous

14C-91. Why Not Use More High Shrinkage Bronze? Harold J. Roast. *Foundry*, v. 77, Nov. 1949, p. 93, 231-236.

Merits of Al and Mn bronzes for high-strength applications. Because of casting difficulties, these alloys have been avoided by many foundries. Recommended procedures for casting.

14C-92. Sleeve Bearing Production Involves Unusual Casting and Machining Procedures. Herbert Chase. *Steel*, v. 125, Oct. 24, 1949, p. 61-63.

14C-93. A Special Die-Casting Method. E. M. H. Lips. *Foundry Trade Journal*, v. 87, Oct. 6, 1949, p. 425-428.

Vacuum die-casting machine developed for production of castings free of inclusions. For normal use, small air inclusions are not harmful, but in special cases their presence may render the product useless. Advantages of the process, which has been applied to Pb and Zn alloys.

14C-94. Economics of Owning a Pressure Die Casting Machine. Eric James. *Light Metal Age*, v. 7, Oct. 1949, p. 8-11, 31-32.

Factors and costs to be considered in deciding whether to make one's own die castings or purchase them. A series of tables lists auxiliary items and pieces of equipment needed in a die-casting plant.

14C-95. Metallurgical Aspects of Heat Checking in Brass Die Casting Dies. Part Two. (Concluded.) A. E. Nehrenberg. *Die Castings*, v. 7, Nov. 1949, p. 33-35, 61-68.

Effects of heating in service on microstructures. Results of examination of welded areas in brass die-casting dies and of cores used in brass die casting. 13 ref.

14C-96. Production Processes; Their Influence on Design. Part XLVIII. Die Casting. Roger W. Bolz. *Machine Design*, v. 21, Nov. 1949, p. 115-124.

14C-97. Casting Parts for Jet-Propulsion Units by the Lost Wax Method. *Machinery* (London), v. 75, Oct. 27, 1949, p. 608-610.

14D—Light Metals

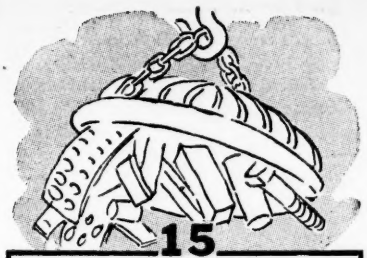
14D-61. Making Special-Duty Castings in Aluminium Alloys. J. Caven and H. W. Keeble. *Foundry Trade Journal*, v. 87, Sept. 29, 1949, p. 401-406; Oct. 6, 1949, p. 421-424, 431.

Details of procedure and equipment for specific large castings.

14D-62. Dégazage des alliages légers fondus à l'aide d'azote sec. (Degasification of Light Alloys by Means of Dry Nitrogen.) Jean Duport. *Fonderie*, Aug. 1949, p. 1709-1711.

Experimental degasification of "Alpax Gamma" (Fe, 0.45%; Si, 9.00%; Cu, 0.03%; Zn, 0.03%; Mg, 0.25%; Mn, 0.03%; Ni, 0.03%; Co, 0.35%; Sn, 0.35%; balance Al) using moisture-free nitrogen. Optimum procedures.

For additional annotations indexed in other sections, see:
3D-75; 9-288; 16B-101; 24A-147



15 SCRAP and BYPRODUCT UTILIZATION

15-73. Recovery of Sulphur From Smelter Gases by the Orkla Process at Rio Tinto. *Bulletin of the Institution of Mining and Metallurgy*, Oct. 1949, p. 23-28.

Operating data for the process as carried out at present at Thamshavn. Discussion of paper by H. R. Potts and E. G. Lawford.

15-74. Preliminary Planning for Plating Room Waste Disposal. C. Fred Gurnham, Barnett F. Dodge, and D. C. Reams. *Plating*, v. 36, Nov. 1949, p. 1136, 1178.

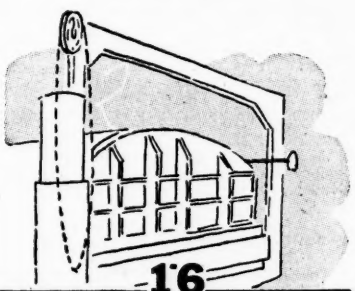
15-75. Waste Gases. Walter A. Schmidt. *Chemical and Engineering News*, v. 27, Nov. 7, 1949, p. 3272-3276.

Methods and equipment for collection and for recovery of valuable metals from the dust carried by them.

15-76. The Recovery of By-Product Metals in the Smelting of Copper Alloy Scrap; A Survey of Published Information. Marjorie E. Whitaker. *Metallurgia*, v. 40, Oct. 1949, p. 295-304.

27 references.

For additional annotations indexed in other sections, see:
7A-169; 14B-133



16 FURNACES and HEATING DEVICES

16A—General

16A-100. Automatic Combustion and Temperature Control on Modern Oil-Fired Furnaces. G. J. Jonas. *Industrial Heating*, v. 16, Oct. 1949, p. 1758, 1760.

16A-101. Induction Brazing and Hardening. Fred M. Burt. *Welding Engineer*, v. 34, Nov. 1949, p. 17-19, 22.

Seven different units of the motor-generator, spark-gap, and electronic-oscillator types used for varied customer-service applications.

16A-102. Dry Coke Cooling. G. E. Foxwell. *Journal of the Institute of Fuel*, v. 22, Oct. 1949, p. 346-353.

Process of quenching coke without use of steam, in order to improve the efficiency of heat utilization. Quality of coke and its suitability for blast-furnace practice. Economics.

16A-103. Heat Loss Through a Solid Floor. H. H. Macey. *Journal of the Institute of Fuel*, v. 22, Oct. 1949, p. 369-371.

Estimation of heat loss through a floor standing solid on the ground and surrounded by a wall, as in kilns, furnaces, and driers.

16A-104. High Speed Gas Heating. Parts II and III. S. L. Case. *Steel Processing*, v. 35, Sept. 1949, p. 497-500; Oct. 1949, p. 545-548.

Part II: Heating of tubular shapes for hot forming operations; continuous heating of bars for annealing or through hardening; applying high-speed gas heating to surface-hardening problems. Part III: Through hardening and tempering; application of high-speed gas heating to brazing problems; induction and high-speed gas heating; surface hardening of steel. (To be concluded.)

16A-105. Electric Furnaces in the Metal Industries. (Concluded.) G. Reginald Bashforth. *Metallurgia*, v. 40, Oct. 1949, p. 304-307.

Various types of low and high-frequency induction furnaces. The electric resistance furnace as used for heat treatment.

16A-106. The Use of Oxygen in the Ferrous and Non-Ferrous Metallurgical Industries. Part II. D. J. O. Brandt. *Journal of the Society of Glass Technology* (Transactions Section), v. 33, June 1949, p. 176-187.

Use of oxygen primarily as an oxidizing agent in openhearth, reverberatory and electric furnaces, converters, and blast furnaces.

16A-107. Gas Permeability of Refractory Linings in Coke Ovens. (In Russian.) B. I. Kustov. *Ogneupory* (Refractories), v. 14, June 1949, p. 256-259.

Loss of gas due to diffusion through the refractory lining and to escape through joints in the lining. Methods of calculating coefficient of permeability and of applying it to calculation of losses. 16 ref.

16B—Ferrous

16B-99. Bearing Balls Hardened Within Close Limits in Automatic-Shaker-Hearth Furnace. J. H. Bradley. *Industrial Heating*, v. 16, Oct. 1949, p. 1734, 1736, 1881.

16B-100. Processing Steel Core Laminations for Electric Products. *Industrial Heating*, v. 16, Oct. 1949, p. 1749-1750, 1752, 1832, 1834.

Enamel-baking oven protected by interlocked safety control of handling, heating, temperature, and circulation.

16B-101. Some Modifications in Cupola Design. E. S. Renshaw and S. J. Sargood. *Foundry Trade Journal*, v. 87, Oct. 13, 1949, p. 449-456.

Modifications introduced successively in an attempt to reduce refractory consumption and increase operating efficiency. Hypothetical slag reactions as an aid in obtaining better slag control. Work on the application of water cooling to the basic cupola, with a table of slag and metal analyses showing the extent of desulfurization obtained.

16B-102. Tracer Study of Sulphur in the Coke Oven. S. E. Eaton, R. W. Hyde, and B. S. Old. *Transactions of the American Institute of Mining and Metallurgical Engineers*, v. 176, 1948, p. 343-362.

Previously abstracted from *Metals Technology*. See item 16b-105, 1948.

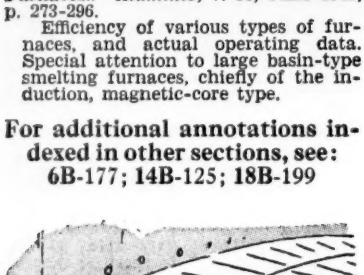
16D—Light Metals

16D-4. Forni a combustione ed elettrici nell'industria dell'alluminio. Parte I. Forni di fusione. (Fuel-Fired and

Electrically Operated Furnaces in the Aluminum Industry. Part I. Smelting Furnaces.) *Aluminio*, v. 18, June 1949, p. 273-296.

Efficiency of various types of furnaces, and actual operating data. Special attention to large basin-type smelting furnaces, chiefly of the induction, magnetic-core type.

For additional annotations indexed in other sections, see: 6B-177; 14B-125; 18B-199



17 REFRACTORIES and FURNACE MATERIALS

17-97. (Book) **Better Refractories for the Furnaces of Industry.** 168 pages. 1949. Mexico Refractories Co., Mexico, Mo.

Story of the Mexico Refractories Co. Firebrick products, standard shapes, specialty products, exports, and technical data.

17-98. (Book) **Refractories.** 272 pages. 1949. General Refractories Co., 1520 Locust St., Philadelphia 2, Pa. $5.00.

A handbook of information for consumers, designers and builders of refractory equipment. History of refractories, manufacture of refractory brick, and their properties and behavior. Lists industries that use refractories and provides a general guide to selection of refractories best suited for particular cases.

17-99. Methods of Analyzing Refractory Consumption. William A. Greene. *Blast Furnace and Steel Plant*, v. 37, Oct. 1949, p. 1199-1204.

Various methods of determining openhearth masonry cost per ingot net ton.

17-100. Experiments With Small Ingots of Rimming Steel. D. Binnie. *Journal of the Iron and Steel Institute*, v. 163, Oct. 1949, p. 159-167.

Ingots up to 300-lb. weight were teemed into hematite molds, copper molds, and into molds partially lined or fully lined with refractory material in order to compare the effect of chill and refractory lining on rimming action. Chemical analysis shows that the refractory-lined mold is superior to the iron mold in general use.

17-101. The Growth of Periclase Crystals and Its Importance in Basic Refractories. E. B. Colegrave, H. M. Richardson, and G. R. Rigby. *Discussions of the Faraday Society*, No. 5 (Crystal Growth), 1949, p. 352-357.

The magnesia used in "magnesite" bricks or blocks is commonly preheated or "dead-burned" prior to forming into shapes in order to prevent excessive shrinkage and tendency toward hydration. Certain impurities, naturally present or added, facilitate the process. Reviews the literature and presents new experimental observations on the structural features of magnesite before and after dead burning, including effects of temperature and impurities. Effects of growth of periclase crystals on volume shrinkage, true specific gravity, and hydration tendency.

17-102. Étude du comportement des briques de chrome-magnésie constituant les voutes des fours électriques. (Problem of Wear of Heat-Resisting Chrome-Magnesite in Crowns of Electric-Arc Steel Furnaces.) A. T. Kleinberg. *Circulaire d'Informations Techniques*, v. 6, Apr.-May 1949, p. 175-178.

Previously abstracted from *Ogneupory* (Refractories). See item 17-52, 1949.

17-103. Progress Review No. 1: The Properties of Refractories. A. E. Dodd. *Journal of the Institute of Fuel*, v. 22, Oct. 1949, p. 361-364.

Developments since 1945. 41 ref.

17-104. Apparatus for Determination of Thermal Resistance of Dinas Brick for Coke Ovens. (In Russian.) I. S. Kainarskii and I. S. Smelyanskii. *Zavodskaya Laboratoriya* (Factory Laboratory), v. 15, July 1949, p. 873-876.

The apparatus applicable to service conditions of coke-oven charging-door caps and for evaluation of the heat resistance of Dinas brick for hearths of coke-oven chambers.

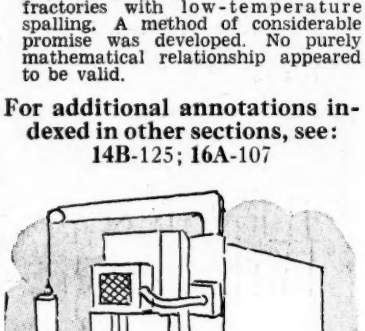
17-105. Operating Characteristics of Crown Dinas Brick (Influence of Absorption of Ferric Oxide by Dinas Brick on Its Tendency to Form Filaments During Overheating). (In Russian.) I. S. Kainarskii and V. D. Tsigler. *Ogneupory* (Refractories), v. 14, July 1949, p. 293-297.

It was found experimentally that the above tendency of Dinas brick decreases as a result of absorption of Fe_2O_3. Optimum conditions for use in the crowns of openhearth furnaces.

17-106. Notch Sensitivity and Low-Temperature Spalling of Fire-Clay Refractories. Ralph Rose and R. S. Bradley. *Journal of the American Ceramic Society*, v. 32, Nov. 1, 1949, p. 360-362.

Attempts were made to correlate physical properties of fireclay refractories with low-temperature spalling. A method of considerable promise was developed. No purely mathematical relationship appeared to be valid.

For additional annotations indexed in other sections, see: 14B-125; 16A-107



18 HEAT TREATMENT

18A—General

18A-32. Untersuchung der Abkühlungswirkung von Kühlmitteln mit dem Kathodenstrahloszillographen. (Investigating the Cooling Effects of Quenching Agents With the Cathode Ray Oscillograph.) H. Te Gude. *Archiv für Metallkunde*, v. 3, Sept. 1949, p. 311-312.

Equipment and procedure. Results for four different oils.

18A-33. The Manufacture of Springs With Low Thermal Coefficients of the Modulus of Elasticity. (Concluded.) Thyssen Bornemisza. *Microtecnic* (English Edition), v. 3, July-Aug. 1949, p. 159-164. Translated from the German.

Annealing of Cr, Cu, and Ni plating to produce low thermal coefficients; and reduction of the elastic after-effect by aging. Manufacturing process for precision springs; variation of modulus of elasticity with temperature for various compositions.

18A-34. The Physical Basis of Heat Treatment. B. Chalmers. *Canadian Metals and Metallurgical Industries*, v. 12, Oct. 1949, p. 12-15.

Second of a series of lectures on fundamentals of metalworking.

18B—Ferrous

18B-198. Deep Case Gas Carburizing of Nash Gears. *Industrial Heating*, v. 16, Oct. 1949, p. 1714-1716, 1718, 1720, 1722, 1724, 1883-1886.

Equipment and procedures.

18B-199. Electric Furnace Annealing Malleable Iron Castings at the Oliver Corporation. R. C. Cox. *Industrial Heating*, v. 16, Oct. 1949, p. 1728-1730, 1732, 1878.

Equipment and procedures.

18B-200. Selective Hardening of Gear Shift Rails in Automatic Machine. Joseph Geschelin. *Automotive Industries*, v. 101, Nov. 1, 1949, p. 36-37.

Induction hardening is applied in a continuous and automatic cycle at the rate of 400 pieces an hour in each of two units.

18B-201. Thermal Treatment; German Forgings, Castings, and Armour Plate. (Concluded.) *Iron and Steel*, v. 22, Oct. 1949, p. 466. Condensed from Section 6, BIOS Overall Report No. 15, "German Ferrous Metal Industry".

Roller and ball bearings and treatment for springs. Quenching directly from rolling, nitriding, and other treatments.

18B-202. Alcuni dati sul trattamento termico dell'acciaio at 2% C e 13% Cr. (Some Data on Heat Treatment of Steel Containing 2% C and 13% Cr.) C. Sapengno and G. Magliano. *La Metallurgia Italiana*, v. 41, Mar.-Apr. 1949, p. 67-70.

Factors influencing the mechanical properties of steel, such as quenching temperature, annealing temperature, and time of annealing.

18B-203. Zur Frage der Stahlhärtung, besonders zur Kinetik der Umwandlungen. (Problems in the Hardening of Steel, Especially Kinetics of the Transformations Involved.) Franz Wever. *Stahl und Eisen*, v. 69, Sept. 15, 1949, p. 664-670.

Work done in the Kaiser-Wilhelm Institut für Eisenforschung from 1920 to 1940. New practical methods of steel hardening and prospects of "intermediate-stage" annealing. 32 ref.

18B-204. Low-Temperature Treatment of High Speed Tools. (In Russian.) A. P. Gulyaev, P. P. Grudov, and A. A. Badaeva. *Stanki i Instrument* (Machine Tools and Instruments), v. 20, Mar. 1949, p. 3-6; Apr. 1949, p. 16-18.

The influence of low-temperature treatment on the cutting properties of tools. Application of very low temperatures, down to −100° C., immediately after heat treatment. Comparative data for different toolsteels.

18B-205. Concerning the Multiple Tempering of Low-Tungsten High Speed Steels. (In Japanese.) Masazo Okamoto and Mituru Nagakura. *Nippon Kinzoku Gakkai-Si* (Journal of the Japan Institute of Metals), v. 13, Apr. 1949, p. 37-39.

Multiple tempering gives superior results with respect to hardness and tool life, especially for high-cobalt steels. Multiple and single tempering of low-tungsten, high speed steels. Effects of Al, V, and Ti on the latter were also studied.

18B-206. Salt-Bath Hardening Increases Churn-Drill Bit Life. Carrol A. Quam. *Mining Engineering* (Feature and News Section), v. 1, Nov. 1949, p. 38-39.

Operation as conducted at the titanium and iron mine of National Lead Co. at Tahawus, N. Y.

18B-207. Keep Up With Tooling. *Production Engineering & Management*, v. 24, Nov. 1949, p. 63.

Set-ups for selective induction hardening tips of valve stems and for automatically gaging valve-stem guides.

18B-208. Induction Hardening. Frank W. Curtis. *Modern Machine Shop*, v. 22, Oct. 1949, p. 124-126, 128, 130, 132, 134, 136, 138, 140, 142, 144, 146, 148; Nov. 1949, p. 144-146, 148, 150, 152, 154, 156, 158, 160, 162, 164, 166, 168.

Oct.: fundamentals for heating and quenching of steel parts. Nov.: steels best adapted to the induction hardening process, proper methods of quenching induction heated workpieces, and progressive hardening.

18B-209. New Machine Flame-Hardens Metal Parts. *Compressed Air Magazine*, v. 54, Nov. 1949, p. 286-287.

Machine made by Cincinnati Milling Machine Co., and some typical setups and pieces hardened in it.

18B-210. Stress Relief Heat Treatment of Alloy Cast Iron. *Foundry Trade Journal*, v. 87, Oct. 13, 1949, p. 457-462, 471.

Discussion, authors' reply, of paper by M. M. Hallett and P. D. Wing.

18B-211. Inter-Crystalline Failure of Bullet-Proof Armour Plate. B. R. Nijhawan. *Journal of Scientific & Industrial Research*, v. 8, Sept. 1949, p. 360-369.

Investigation to determine causes of failure. Recommendations for modification of heat treating procedure.

18B-212. High-Speed Steels; Their Manipulation and Heat Treatment. H. W. Pinder. *Alloy Metals Review*, v. 7, Sept. 1949, p. 2-8.

Includes rolling, forging, etc. Photomicrographs show structures involved.

18B-213. Residual Stresses of Fe-Ni Alloys Variously Heat Treated. (In Japanese.) Keizo Iwase and Tadao Sano. *Nippon Kinzoku Gakkai-Si* (Journal of the Japan Institute of Metals), v. 13, Jan. 1949, p. 17-21.

Fe-Ni alloys (3-30% Ni) were cooled from 1050° C. to room, ice-water, or liquid-air temperatures at various rates. Stresses were measured by dissolving one side of the specimen layer by layer and measuring the exact change in length. Conclusions with respect to stress and structural changes are summarized in English.

18B-214. Changes of Dimensions and Shapes of Fe-Ni Alloys Variously Heat Treated. (In Japanese.) Tadao Sano. *Nippon Kinzoku Gakkai-Si* (Journal of the Japan Institute of Metals), v. 13, Jan. 1949, p. 22-25.

Experimental results obtained with eight alloys containing 6.0-31.6% Ni. Correlation with phase transformations.

18B-215. Selection of Steel for Automobile Parts. What Engineers Should Know Today About Hardenability-Band Steels. Part IV. Hardenability Selection Methods. *SAE Journal*, v. 57, Nov. 1949, p. 39-48.

Charts show details of procedure. Variations of structure with hardness are illustrated by photomicrographs. (To be continued.)

18B-216. Articulation of Alloy Steel Fixtures to Withstand Quenching Stresses. I. George C. McCormick. *Industrial Heating*, v. 16, Oct. 1949, p. 1782, 1784, 1786, 1788, 1790, 1792-1793.

Design of quenching trays and fixtures. Principles applied to rigid trays. Such devices as rounded corners and offset intersections result in much greater ability to withstand stresses. "Articulated" trays consist of several parts joined with flexible joints.

18B-217. Automatic Induction Hardening Speeds Dodge Output. Charles H. Wick. *Machinery* (American), v. 56, Nov. 1949, p. 194-198.

Various applications of selective surface hardening by means of induction heating, which have resulted in faster heating and minimum distortion and scaling.

18B-218. First-Stage Annealing of Malleable Iron. J. E. Rehder. *Canadian Metals and Metallurgical Industries*, v. 12, Oct. 1949, p. 20-22, 25.

How time necessary for first-stage annealing of blackheart malleable can be calculated from temperature and silicon content.

18B-219. Some Factors Involved in the Hardening and Tempering of Steel. *Metallurgia*, v. 40, Oct. 1949, p. 308-312.

Based on lecture by Morris Cohen. Includes transformation diagrams and graphs.

18B-220. Die autogene Oberflächenhartung; La trempe superficielle au chalumeau. (Surface Flame Hardening.) (Concluded.) H. Bauer. *Zeitschrift für Schweisstechnik; Journal de la Soudure*, v. 3, Mar. 1949, p. 47-51.

Hardening of cast iron and cast steel; adjustment of the burner and quenching spray; method of controlling depth of hardness; pre and post treatment of steel for optimum results.

18B-221. Das Gasglühfrischen von Temperrohguss. (Gas Annealing of Malleable Cast Iron.) Walter Baukloh. *Chemische Technik*, v. 1, Aug. 1949, p. 41-50.

Process can be performed without the usual charge of ore and sand, and physicochemical data indicate that the carbon content of the iron can be easily controlled by using the proper gas mixtures at suitable temperatures. Transformations in the Fe-O-C and Fe-C-H systems, effects of alloying elements, and decarburization in different gases. 12 ref.

18B-222. An Evaluation of Quenching Oils by Means of the End Quench Test. C. A. Siebert and G. Sandoz. *Transactions of the American Institute of Mining and Metallurgical Engineers*, v. 176, 1948, p. 416-421; discussion, p. 421-423.

Previously abstracted from *Metals Technology*. See item 18b-59, 1948.

18B-223. Secondary Hardening of Tempered Martensitic Alloy Steel. W. Crafts and J. L. Lamont. *Transactions of the American Institute of Mining and Metallurgical Engineers*, v. 180, 1949, p. 471-512.

Previously abstracted from *Metals Technology*. See item 18b-144, 1948.

18B-224. Temper Brittleness of Plain Carbon Steels. L. D. Jaffe and D. C. Buffum. *Transactions of the American Institute of Mining and Metallurgical Engineers*, v. 180, 1949, p. 513-518.

Previously abstracted from *Metals Technology*. See item 18B-1, 1949.

Abstracts of 1390 articles on

HEAT TREATMENT

Published during the past five years are available to you. *Complete your set of five volumes of A.S.M. Review of Metal Literature now.* Order from American Society for Metals, 7301 Euclid Ave., Cleveland 3, Ohio.

BRIGHT ANNEALING AND NORMALIZING STEEL STRIP *Continuously*

● EF continuous annealing and normalizing furnaces subject the entire length of the coil to exactly the same time and temperature cycle, producing extreme uniformity of grain size, resulting in superior qualities for deep drawing.

These furnaces shorten the annealing and normalizing cycle – and reduce the tonnage of material in process. Tension on the strip, the speed of travel and the atmosphere in the furnace are accurately controlled, producing the exactly desired surface finish and physicals – day after day. Capacities to meet any requirement.

THE ELECTRIC FURNACE CO.
GAS FIRED, OIL FIRED AND ELECTRIC FURNACES *Salem - Ohio*

EF

GAS-FIRED OIL-FIRED and ELECTRIC FURNACES *for*

AGING
ANNEALING
BRAZING
CARBON RESTORATION
CARBURIZING
CERAMIC DECORATING
DRAWING
HARDENING
HOMOGENIZING
MALLEABLIZING
NORMALIZING
NITRIDING
SINTERING
SOLUTION TREATING
SPECIAL ATMOSPHERE TREATMENTS

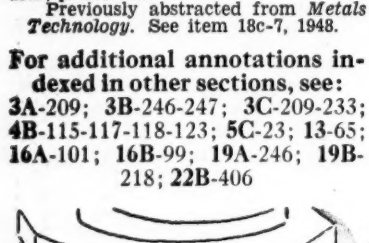
A SIZE AND TYPE OF FURNACE FOR EVERY PROCESS PRODUCT OR PRODUCTION

18C-13. Decarburization of Chrome Nickel Alloys by Their Surface Oxides in High Vacua and at Elevated Temperatures. E. A. Gulbransen, W. S. Wysong, and K. Andrew. *Transactions of the American Institute of Mining and Metallurgical Engineers*, v. 180, 1949, p. 565-578.

Previously abstracted from *Metals Technology*. See item 18c-7, 1948.

For additional annotations indexed in other sections, see:

3A-209; **3B**-246-247; **3C**-209-233; **4B**-115-117-118-123; **5C**-23; **13**-65; **16A**-101; **16B**-99; **19A**-246; **19B**-218; **22B**-406



19 WORKING

19A—General

19A-245. Photo-Grid Method Aids Sheet Forming Studies. *Iron Age*, v. 164, Oct. 27, 1949, p. 76. Based on *National Advisory Committee for Aeronautics*, Technical Notes 1010, 1385, 1512, and 1513.

Technique developed by National Bureau of Standards.

19A-246. Fundamentals of the Working of Metals. Part IV. Relations Between Chemical Composition, Grain Structure, Hot Working, and Annealing. George Sachs. *Modern Industrial Press*, v. 11, Oct. 1949, p. 6, 8, 24.

19A-247. Giant Press Concentrates Production of Decorative Panels and Name Plates at Etched Products Corporation. Floyd McKnight. *Modern Industrial Press*, v. 11, Oct. 1949, p. 13-14, 24.

19A-248. The "Hydrodynamic Process". E. Weller. *Modern Industrial Press*, v. 11, Oct. 1949, p. 42, 44, 46.

Process for forming shallow sweeps and shapes and for drawing cone-shaped and tapered stampings in one operation, by use of a fluid punch. Typical products.

19A-249. Advanced Power Press Brake Technique Developed at Temco. *Modern Industrial Press*, v. 11, Oct. 1949, p. 56.

A saving of 5-6 min. per section on end-flanged ducting has been achieved at Texas Engineering and Manufacturing Co., Dallas.

19A-250. Tungsten Carbide Tooling for Cold Heading. Part II. (Concluded.) W. E. Montgomery, W. Leigh, and W. H. Phillips. *Steel Processing*, v. 35, Oct. 1949, p. 531-536, 563.

Design of dies applied to various typical product forms. Factors to be considered when deciding whether or not to use carbide dies. Production data on carbide dies used to produce difficult and easy-to-head products.

19A-251. Reactive Wire Drawing With Hydraulically-Operated Variable Speed Transmission. *Wire Industry*, v. 16, Sept. 1949, p. 727-729.

New British equipment.

19A-252. Diagrammatic Calculation of Die Sizes; Multiple Machine Sets. E. L. Baay. *Wire Industry*, v. 16, Sept. 1949, p. 735, 737-738.

Diagrams for multiple wiredrawing; examples of their use.

19A-253. Flame Spinning: A Method of Forming Steel and Other Metals. K. Harper. *Iron and Steel*, v. 22, Oct. 1949, p. 448-450.

Process and applications. The work is formed by a suitable tool while being rotated, as in conventional spinning, but is simultaneously heated by gas flames.

19A-254. Wire-Drawing Machines; Application of "VSG" Hydraulic Variable-Speed Drives. *Iron and Steel*, v. 22, Oct. 1949, p. 461-462, 468.

19A-255. The "Pathfinder" Back-Pull Wire-Drawing Machine. *Engineering*, v. 168, Sept. 30, 1949, p. 333-336.

19A-256. Designing Tools for Cold Roll-Forming. Richard T. Angel. *Iron Age*, v. 164, Nov. 3, 1949, p. 83-88.

Design of rolls, guides, punches, coilers, shears, and other tools used for equipment for cold roll-forming metal sections. Formulas for specific design features, as well as factors affecting performance of such tools.

19A-257. An Analysis of Shaving and Burnishing Dies. C. W. Hinman. *Modern Machine Shop*, v. 22, Nov. 1949, p. 174-176, 178, 180, 182, 184.

Several commonly used die designs for handling work economically in shaving dies.

19A-258. A Contributor Discusses Cold Extrusion of Steels, and Its Possible Effect on Wire Production. *Wire Industry*, v. 16, Oct. 1949, p. 805.

Potentialities of new process recently developed in the U. S.

19A-259. Profile Testing for Wire Drawing Dies. *Wire Industry*, v. 16, Oct. 1949, p. 810. From article by H. Mucke, *Stahl und Eisen*, v. 68, Dec. 2, 1948, p. 484.

19A-260. Pre-Spun Shapes Aid Drop Hammer Forming. Gilbert C. Close.

Fast Accurate Economical Dependable

CONSTANT TEMPERATURES MAINTAINED WITH

SENTRY

HIGH TEMPERATURE

TUBE FURNACES

Sentry Tube Furnaces are built in single and dual tube models with a selection of tube sizes to meet the requirements of the laboratory for carbon determinations, combustion analyses, calibrating and general laboratory use. The high operating temperatures (up to 2550°F and with special lining to 2750°F) and the ease of control over a wide range of temperatures make these furnaces outstanding for the many applications for which they are designed.

Write for bulletin 1016-G5.

Manufacturers of Sentry High Speed Steel Hardening Furnaces and Sentry Diamond Blocks.

The Sentry Company

FOXBORO, MASS., U. S. A.

Sentry DIAMOND Block

METALLURGICAL ABSTRACTS

(GENERAL AND NON-FERROUS)

Comprehensive and authoritative, will keep you informed of the world's progress in research and practice in general and non-ferrous metallurgy.

Free to members of the Institute of Metals, they may be obtained by non-members either monthly, with the *Journal of the Institute of Metals* for £5 per annual volume or bound for £3 per annum (not including the Journal), both inclusive of indexes and the former inclusive of binding case.

The sections cover (1) properties of metals; (2) properties of alloys; (3) structure; (4) dental metallurgy; (5) powder metallurgy; (6) corrosion and related phenomena; (7) protection; (8) electro deposition; (9) electro-metallurgy and electro chemistry; (10) refining; (11) analysis; (12) laboratory apparatus, instruments, etc.; (13) physical and mechanical testing, inspection and radiology; (14) temperature measurement and control; (15) foundry practice and appliances; (16) secondary metals, scrap, residues, etc.; (17) furnaces, fuels and refractory materials; (18) heat-treatment; (19) working; (20) cleaning and finishing; (21) joining; (22) industrial uses and applications; (23) miscellaneous; (24) bibliography; (25) book reviews.

Nature says: "To the Metallurgists, both theoretical and practical, as well as to chemists, physicists and engineers, these volumes have become essential."

A specimen copy may be obtained from:

THE INSTITUTE OF METALS

4 Grosvenor Gardens LONDON, S. W. 1., Eng.

Light Metal Age, v. 7, Oct. 1949, p. 6-7, 29.

It was theorized that prespinning of metal parts into neutral shapes prior to drop-hammer forming would eliminate the necessity of using the first several sets of staging dies, and that the partial control of metal thickness possible during this prespinning process could be used to offset excessive thinning caused by localized metal draw. Investigations led to verification of these advantages. Some parts could be formed in this way that were impossible to form by use of drop-hammer forging alone. Metals used are mainly Al alloys, but the process has also been successfully applied to brass, a Mg alloy, terneplate, and stainless steel.

19A-261. Precision Forging of Gas Turbine Blades. C. H. Smith. *Machinery* (London), v. 75, Oct. 13, 1949, p. 511-516.

As done at Steel Improvement & Forge Co. Includes inspection procedures.

19A-262. Laboratory Determination of Efficiency of Impact During Press Forming. (In Russian.) P. G. Kirillov. *Zavodskaya Laboratoriya* (Factory Laboratory), v. 15, July 1949, p. 828-830.

An indirect method for the above. The incorrectness of recommending practically constant values of efficiency for impact forming under different deformation conditions. A photographic method of determining deformation.

19A-263. Select Spring Strippers According to Die Requirements. J. R. Paquin. *American Machinist*, v. 93, Nov. 17, 1949, p. 92-94.

Spring stripper plates are made in several ways, depending on the class of die, its size, and possibility of jams arising while in service. The various design arrangements.

19A-264. How Modern Mechanical Presses Operate. Sergius D. Brootzkoos. *American Machinist*, v. 93, Nov. 17, 1949, p. 101-116.

Analysis of mechanical presses, and the kinds of work they handle.

19A-265. Sources of Mechanical Power Presses. Sergius D. Brootzkoos. *American Machinist*, v. 93, Nov. 17, 1949, p. 137.

Companies supplying various types are shown in tabular form.

19A-266. Rolls and Rolling. Part IX. E. E. Brayshaw. *Blast Furnace and Steel Plant*, v. 37, Oct. 1949, p. 1213-1222, 1231-1232, 1253.

Roll-pass sequences for production of square and related shape bars. (To be continued.)

19A-267. (Book) **Cold Working of Metals.** 364 pages. 1949. American Society for Metals, Cleveland, Ohio.

Papers given at a seminar held during the 13th National Metal Congress and Exposition, Philadelphia, Oct. 23-29, 1948. Individual papers are abstracted separately.

19B—Ferrous

19B-208. Production of Seamless Steel Pipe and Tubes. Bryant Bannister. *Steel*, v. 125, Oct. 17, 1949, p. 86, 88, 91, 94, 96; Oct. 24, 1949, p. 68, 70, 72, 74, 76.

Equipment and procedures. Part I: billet heating, piercing, plug rolling, and reeling. Part II: seamless tube rolling process used today. The new continuous tube-rolling mill now being installed by National Tube Co.

19B-209. New Rod Mill To Increase Production at Colorado Fuel and Iron Corp. *Steel*, v. 125, Oct. 24, 1949, p. 58-60, 82, 85-86.

New mill which will roll 4⅜-in. square billets through 27 passes into finished coiled rods.

19B-210. Mass Press-Forming Figures Prominently in Steel House Production. *Steel*, v. 125, Oct. 24, 1949, p. 64-65.

Forming and finishing operations at Lustron Corp.

19B-211. Press Work Behind the Iron Fireman. Walter Rudolph. *Modern Industrial Press*, v. 11, Oct. 1949, p. 36, 38, 40.

Press operations and equipment in production of "Iron Fireman" heating units for automatic burning of coal, oil, or gas. Includes welding, machining, and finishing.

19B-212. A Modern Rod Mill for Rolling Stainless Steels. Edward T. Peterson, Lewis W. King, and Edward C. Peterson. *Iron and Steel Engineer*, v. 26, Oct. 1949, p. 99-109; discussion, p. 109.

Development of modern layouts for mechanized rolling of stainless. Mechanization has been made feasible in spite of several inherent problems peculiar to the material.

19B-213. Hobbing Cavities in Alloy Steels. John Sekowski. *Steel*, v. 125, Oct. 31, 1949, p. 62-63.

How long-running, trouble-free cavities for molding plastics can be produced economically by hobbing techniques.

19B-214. New Criteria for Predicting Press Performance of Deep Drawing Sheets. W. T. Lankford, S. C. Snyder, and J. A. Bauscher. *Steel Processing*, v. 35, Oct. 1949, p. 550-551, 563.

Previously abstracted from *American Society for Metals*, Preprint No. 30, 1949. See item 19B-207, 1949.

19B-215. Flame Fabricating Structural Steel. F. H. Dill. *Steel*, v. 125, Nov. 7, 1949, p. 128, 160, 162, 165.

Use of oxy-acetylene equipment for local heating, straightening and forming, fabricating large structures, cambering beams, and heating flanges.

19B-216. Cupping Thick Steel Blanks. G. Sachs, G. Espey, and J. Taub. *Steel*, v. 125, Nov. 7, 1949, p. 112-115; Nov. 14, 1949, p. 87-90, 92, 94.

Experimental methods used to study cupping phenomena, contours of cupping dies, stress and strain relations, breaking conditions, cupping, and ironing forces.

19B-217. Experimental Determination of Metal Drawing and Forming Forces. Arthur R. Kimbell. *Proceedings of the Society for Experimental Stress Analysis*, v. 7, no. 1, 1949, p. 51-60.

Application of wire strain gages to the problem of load measurement on cupping and redrawing dies used in drawing various sizes of nuts from strip steel.

19B-218. Forging Techniques in a New Ford Plant. Charles H. Wick. *Machinery* (American), v. 56, Nov. 1949, p. 136-145.

Induction and high-speed gas heating, multiple and hot extrusion forging, and isothermal annealing are some of the methods used in producing 1,000,000 lb. of forgings per day.

19B-219. High Production of Difficult Stampings for the New Studebaker. William R. Myers. *Machinery* (American), v. 56, Nov. 1949, p. 180-185.

Spinner-type grilles, one-piece fenders, and "down-swept" hoods are among the stampings required. Methods of forming such components smoothly and to close dimensional accuracies at high production rates.

19B-220. Hot-Worked Cast Iron. E. Piwowarsky and A. Wittmoser. *Engineers' Digest*, v. 10, Oct. 1949, p. 348-350. Translated and condensed from *Zeitschrift für des Vereines Deutscher Ingenieure*, v. 91, Apr. 15, 1949, p. 183-185.

Development of high-strength cast irons by hot working, especially over the past 15 years at the Foundry Institute of Aachen Technical University. Comparative mechanical properties.

19D—Light Metals

19D-61. Sheet and Strip Rolling at Oldbury. *Light Metals*, v. 12, Oct. 1949, p. 560-563.

Some of the operations involved in production of pure Al and Al alloy sheet and strip.

19D-62. The New Factory of the Société Centrale Des Alliages Légers at Issoire (Puy-De-Dôme) for the Working of Light Alloys. Jean Matter and Marcel Lamourdedieu. *Journal of the Institute of Metals*, v. 75, Aug. 1949, p. 899-920.

19D-63. Some Technical Problems Influencing Production Economy in the Rolling of Aluminium. W. J. Thomas and W. A. Fowler. *Journal of the Institute of Metals*, v. 75, Aug. 1949, p. 921-948.

Present difficulties, possible causes, and suggested remedies. Casting large slabs by a semi-continuous method and defects encountered; hot rolling of Al alloys; cooling and lubrication of the rolls; coolant properties; production of intermediate-temper rolled metal by thermal treatment rather than cold working; means of producing fine-grained metal; and continuous heat treatment of sheet before cutting the coils to desired lengths.

19D-64. Forging and Stamping Light Alloys. The Issoire Works of the Société Forgeal. R. Colomb. *Metal Industry*, v. 75, Oct. 14, 1949, p. 333-335.

Equipment, procedures. Tables show compositions of alloys used, minimum guaranteed mechanical properties, and heat treatment schedules.

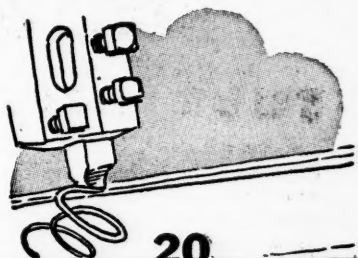
19D-65. Aluminum Wire. *Light Metal Age*, v. 7, Oct. 1949, p. 12-13.

Procedures and equipment for production at Permanente Metal Corp.'s new plant in Newark, Ohio.

19D-66. Hydraulic Press Technique. *Light Metal Age*, v. 7, Oct. 1949, p. 13.

Procedures and equipment used in forming of aluminum cooker shells with bulged side sections for electric ranges.

For additional annotations indexed in other sections, see: 3A-215-217-219-220; 4A-130-131-132-133-134-137-138-139; 18B-212; 20A-474-492; 20B-157-162; 21B-72; 24A-148; 24D-24



20

MACHINING and MACHINABILITY

20A—General

20A-450. Rotary Drill Jig Reduces Machine Downtime. *Iron Age*, v. 164, Oct. 20, 1949, p. 74.

Jig for production of cast low-pressure discharge manifolds. Problems of moving the jig and rotating it for drilling are overcome by use of a rotary jig of novel design.

20A-451. Designing Carbide Insert Tools and Holders for Special Purposes. *Modern Industrial Press*, v. 11, Oct. 1949, p. 54, 56.

20A-452. Planning Production of Machined Parts. T. O. Davies. *Western Machinery and Steel World*, v. 40, Oct. 1949, p. 62-65.

Procedures for planning of tooling for machined aircraft parts.

20A-453. Tapered Skins Save Weight. A. C. Slatter and J. J. Sloan. *Western Machinery and Steel World*, v. 40, Oct. 1949, p. 78-81.

Production of tapered metal sheets for aircraft use by machining.

20A-454. Checks Insure Accuracy. *Western Machinery and Steel World*, v. 40, Oct. 1949, p. 93.

Regular testing procedure applied to hobbing machines at Westinghouse's Sunnyvale plant to insure accurate alignment.

20A-455. What Is the Best Buy in Cutting Fluids? O. S. Miller. *Western Machinery and Steel World*, v. 40, Oct. 1949, p. 94-95.

Factors to be considered in selection.

20A-456. Unusual Screw Machine Operations. Herbert Chase. *Steel*, v. 125, Oct. 31, 1949, p. 51-52.

Buick setups which adapt automatics to machining of long shift levers, helical grooves on speedometer shaft with single-point tool, and to cross-drilling of small stepped control valves.

20A-457. Unusual Operations on Shaping Machines. J. J. Murphy. *Machinery* (London), v. 75, Oct. 6, 1949, p. 485-487.

Several setups for high-production operations in which a number of cuts are made simultaneously.

20A-458. Nomogram for Turning and Boring Times. O. F. Mayer. *Machinery* (London), v. 75, Oct. 6, 1949, p. 490.

Includes illustrative example.

20A-459. Die Bedeutung des Feinzieh-schleifens; Entwicklung und Stand des Verfahrens. (Significance of the Superfinishing Process; Its Development and Status.) Herwart Opitz and Karl Krümmel. *Zeitschrift des vereines Deutscher Ingenieure*, v. 91, Sept. 1, 1949, p. 417-424.

Wear resistance of bearing surfaces depends largely on surface conditions. Experimental results and methods of applying superfinishes. Equipment and resulting surfaces. 20 ref.

20A-460. Errors of Single-Start Hobs for Involute Gears as Used in Precision Instruments and Their Influence on the Generated Tooth Shape. (Continued.) Herbert Göttsching. *Microtecnic* (English Edition), v. 3, July-Aug. 1949, p. 146-152. Translated from the German.

Detailed analysis, illustrated by diagrams.

20A-461. Down Cut Gear Milling Machines. A. Léauté and F. Jombart. *Microtecnic* (English Edition), v. 3, July-Aug. 1949, p. 182-186. Translated from the French.

20A-462. Heating During Cutting of Metal. (In Russian.) G. A. Oding. *Doklady Akademii Nauk SSSR* (Reports of the Academy of Sciences of the USSR), new ser., v. 66, June 1, 1949, p. 585-587.

Relationship between machinability and heating of a carbon steel. Method of study

20A-463. Energy Balance in the Metal Cutting Process. (In Russian.) G. I. Epifanov and P. A. Rebinder. *Doklady Akademii Nauk SSSR* (Reports of the Academy of Sciences of the USSR), new ser., v. 66, June 1, 1949, p. 653-656.

Attempts to determine the part of the energy absorbed by the plastic deformation of turnings and to establish the influence of surface-active media on the value of absorbed energy. Method of investigation and test apparatus.

20A-464. Method of Theoretical Analysis and Calculation of Characteristics of Drill Presses. (In Russian.) A. I. Kashirin and F. A. Barbashov. *Stanki i Instrument* (Machine Tools and Instruments), v. 20, Apr. 1949, p. 1-7.

Method of determining productive capacities of individual tools and their operating conditions. Diagrams plotted according to this method permit determination of basic parameters of operation and most advantageous order of operation.

20A-465. Simultaneous Grinding and Checking Method. *Steel*, v. 125, Nov. 7, 1949, p. 118-119.

Procedure devised by Cincinnati Milling Machine Co. which gives complete control of vertical and transverse movements necessary to grind an accurate profile, and also supplies an optically enlarged view of the shape of the workpiece plus a master drawing made to the same ratio.

20A-466. Standard Clamping and Holding Devices. *Tool & Die Journal*, v. 15, Nov. 1949, p. 53-56, 58.

Variety of devices used in machining operations

20A-467. New Davenport Attachment Speeds Milling Operations. *Screw Machine Engineering*, v. 11, Nov. 1949, p. 27-30.

Screw-machine setups for milling hexagons or washer-faced nuts. By adding a mechanism known as a "Revinloc" to a rotary slotting attachment equipped with two milling cutters, it is possible to mill the three sets of flats which produce the hexagon in 0.6 sec.

20A-468. Turret Lathe Practice. E. L. Murray. *Screw Machine Engineering*, v. 11, Nov. 1949, p. 32-35.

Recommended practice is summarized and clarified by examples.

20A-469. Converted Bar Automatic Machines 4,000 Parts Per Hour. *Screw Machine Engineering*, v. 11, Nov. 1949, p. 41-43.

The part referred to is a cast iron valve-guide bushing which requires a groove cut in the large outside diameter. Each spindle and cross slide combine to machine a separate part simultaneously.

20A-470. Cleveland Model AB Dialmatic. *Screw Machine Engineering*, v. 11, Nov. 1949, p. 50-53.

Details of single spindle, five-hole turret automatic.

20A-471. Maintenance of Carbide Insert Holders and Tools. *Screw Machine Engineering*, v. 11, Nov. 1949, p. 59.

Recommendations.

20A-472. Machining Operations on Hoover Cleaners. Fred W. Vogel. *Modern Machine Shop*, v. 22, Nov. 1949, p. 116-118, 120, 122.

20A-473. Ideas From Readers. *Modern Machine Shop*, v. 22, Nov. 1949, p. 206, 208, 210, 212, 214, 216, 218.

"Using a Lathe as a Milling Machine", Robert Mawson; "An Adjustable Tool for Finishing Ball Seats", Roger Isetts; "A Method for Spacing Slitter Rolls", Wallace C. Mills; and "A Simple Method for Aligning Milling Machine Cutters", Michael Axler.

20A-474. Low Cost Tooling. Estimating and Economics. 1. Predesign Estimating. G. M. Foster. **2. Postdesign Estimating.** George S. Clarke. *Tool Engineer*, v. 23, Nov. 1949, p. 25-29.

Concerned with machine-shop and press operations.

20A-475. Design of Fixture Elements: Clamps. Hans W. Smith. *Tool Engineer*, v. 23, Nov. 1949, p. 34-36.

Examples of typical recommended designs.

20A-476. Gadgets. *Tool Engineer*, v. 13, Nov. 1949, p. 46-47.

"Spot Facer for Narrow Places", H. Moore; "Micrometers on Lathe Hand Wheels", Hugh Maroney; "Milling on the Punch Press", Robert Mawson; "Rubber Pad for Sweep Cutter" C. G. Spicer; "Collet for Gripping Bar Automatically", F. E. Riley; and "Automatic Container Closer", J. H. Quakimeyer.

20A-477. Recent Developments in Contour Friction Sawing. *Machine and Tool Blue Book*, v. 45, Nov. 1949, p. 119, 124.

20A-478. Cutting Fluids. H. W. Smith. *Production Engineering & Management*, v. 24, Nov. 1949, p. 43-46.

Types and applications; their effect on various machining factors. Heavy-duty soluble oils have been developed which, through special additives, can replace mineral oils.

20A-479. High Output Obtained With Production Drilling Units. *Production Engineering & Management*, v. 24, Nov. 1949, p. 47.

Machine which performs hollow milling, spot facing, drilling, and tapping operations economically. Machine is equipped with individual power units.

20A-480. Cutting Sprockets for Silent Chain Drives With One Pair of Cutters. J. L. Jessup. *Machinery* (London), v. 75, Oct. 13, 1949, p. 524-526.

Calculations required for setting up the operation and for designing the required cutters.

20A-481. The Manufacture of Turbine Blades. Methods Employed by the Brush Electrical Engineering Co., Ltd. *Machinery* (London), v. 75, Oct. 20, 1949, p. 547-554.

20A-482. Herbert-Swift Lathe With Optical Control. *Machinery* (London), v. 75, Oct. 20, 1949, p. 568-573.

New development for accurate positioning of cutting tools in obscured positions.

20A-483. Second-Operation Costs Reduced by Special Equipment. Thomas J. Johnson. *American Machinist*, v. 93, Nov. 17, 1949, p. 85-89.

Setups for a variety of small-part jobs involving drilling, deburring, and tit removal which cannot be done with screw-machine attachments.

20A-484. Two Methods Lap Small Curved Surfaces. Chester S. Ricker. *American Machinist*, v. 93, Nov. 17, 1949, p. 96-97.

How diesel-injector valves and hydraulic-valve tappets for automobiles are both curve-lapped. Size differences make it necessary to use two different methods.

20A-485. Stopping Fires in Screw Machines. Walter E. Morgan. *American Machinist*, v. 93, Nov. 17, 1949, p. 118-119

Automatic extinguishing system built into screw machines using light cutting oil extinguishes flash fires without serious damage.

20A-486. Practical Ideas. *American Machinist*, v. 93, Nov. 17, 1949, p. 120-124.

Scaling tool and V-groove core increase cast-pulley output (Frederick G. Hawk); spring-loaded boring tool relieves itself for roughing (Daniel Love); laminated bushing braces drill for piercing stainless steel (Basil Clark); dial-indicator stand permits close final adjustment (R. B. Wolverhampton); precision drilling jig speeds spot-drilling on accurate layouts (N. Bonamini); electronic circuit indicates bar-stock temperature (Chapman Valve Mfg. Co.); grinder safety shield switches on motor (F. E. Riely); life of carbide inserts increased by brazing (Stanley R. Welling); gaging disks check holes in machined housings; and other miscellaneous shop hints.

20A-487. How To Estimate Drilling and Boring Costs on Boring Mills. Herbert W. Brown. *Machinery* (American), v. 56, Nov. 1949, p. 200-204.

Fourth in a series of articles on estimating machining costs in the job shop.

20A-488. Tool Engineering Ideas. *Machinery* (American), v. 56, Nov. 1949, p. 205-208.

Indexing fixture with quickly removable bushing bar, Harold E. Murphey; Special arbor and key for holding gear blank while machining, Stanley R. Welling; Simple diaphragm pump for removal of liquids, Edwin F. Mosthaf; Centralizing tool that simplifies milling cutter setup, J. Homewood; Chip shield for milling fixture clamps, Cliff Bossmann.

20A-489. Certain Problems of the Dynamics of Transverse Planing Machines. (In Russian.) Yu. I. Anosov. *Stanki i Instrument* (Machine Tools and Equipment), v. 20, May 1949, p. 10-13.

Theoretical analysis of a series of problems using electrical analogies and models.

20A-490. Polishing of Hard-Alloy Blades. (In Russian.) R. M. Kolker. *Stanki i Instrument* (Machine Tools and Equipment), v. 20, May 1949, p. 17-19.

Method of polishing cutting tips made of hard, nonmagnetic alloys and joined by copper solder. Operation of recommended machine and step-by-step procedure.

20A-491. Analysis of Methods for Evaluating Sharpness of Cutting-Tool Edges. (In Russian.) A. I. Grechukhin. *Stanki i Instrument* (Machine Tools and Equipment), v. 20, May 1949, p. 21-22.

Several methods commonly used in the U.S.S.R. Specific applicability of each.

20A-492. Technical Basis for Standardization of the Electrical-Energy Consumption of Metal-Working Plants. (In Russian.) A. L. Matveer. *Promyshlennaya Energetika* (Industrial Power), v. 6, June 1949, p. 5-7.

Standard energy consumption data for different machine-shop and press operations on different metals and alloys.

20B—Ferrous

20B-157. Die Sinking for Drop Forging. Part V. Die Sinking. John Mueller. *Steel Processing*, v. 35, Oct. 1949, p. 542-543, 564-565.

Precision machine-shop work of the "die sinker", a skilled craftsman who prepares and maintains drop-forging-hammer dies.

20B-158. Hot Milling Possibilities. A. O. Schmidt and J. R. Roubik. *Automotive Industries*, v. 101, Nov. 1, 1949, p. 28-31, 67.

Four different ways to machine heated workpieces. Reduction in power requirements when the workpiece is heated. Other factors involved.

20B-159. The Manufacture of Radial Flow Steam Turbines. *Machinery* (London), v. 75, Oct. 6, 1949, p. 475-484.

Machine-shop methods and equipment used by British firm.

20B-160. Honing Process Improved With Water Soluble Coolant. *Production Engineering & Management*, v. 24, Nov. 1949, p. 59-60.

Process has cut production cost and reduced time for honing cylinder bores at Studebaker Corp.

20B-161. Motor-Frame Slotting Handled by Keyseater. Harold C. Andree. *American Machinist*, v. 93, Nov. 17, 1949, p. 97.

Procedure, substituted for conventional milling when a limited quantity of large motor frames were slotted to receive stator laminations.

20B-162. Big Tools Machine Massive Cyclotron. *American Machinist*, v. 93, Nov. 17, 1949, p. 98-99.

Picture story of production of Columbia University's new cyclotron by Bethlehem Steel. Includes forging operations.

20B-163. Modern Tooling Methods Employed in Building Cadillac's High-Compression Engine. F. M. Prucha. *Machinery* (American), v. 56, Nov. 1949, p. 146-153.

"Turn-milling" of crankshafts, transfer-machining of cylinder heads and blocks, and unique precision boring setups are among the more interesting features.

20B-164. Transfer Type Machines Produce Reo's "Gold Comet" Truck Engine. A. W. Zimmer. *Machinery* (American), v. 56, Nov. 1949, p. 154-161.

An example of the application of high-production equipment to low-production requirements in order to obtain a more accurate, higher quality product at lower cost.

20B-165. Cost-Cutting Machine Tools Boost Buick's Production. Jesse L. Powers. *Machinery* (American), v. 56, Nov. 1949, p. 162-169.

Increasing automotive production, while reducing costs and improving quality, was made possible by modern machines and tooling methods.

20B-166. Packard's Ultramatic Drive Built by Precision Manufacturing Methods. E. G. Patzkowsky. *Machinery* (American), v. 56, Nov. 1949, p. 170-179.

Extremely smooth surface finishes, a high degree of flatness, and close tolerances are required on many parts of the ultramatic drive. Manufacturing processes developed to build these precision mechanisms economically on a high-production basis. (To be continued.)

20B-167. Experimental Investigation of Honing of Cylinder Bores. (In Russian.) S. M. Kedrov. *Stanki i Instrument* (Machine Tools and Equipment), v. 20, May 1949, p. 6-10.

Experiments were performed on steel and cast-iron cylinders of 90-mm. diameter and 600-mm. length. Method of calculating optimum design of honing machine.

20C—Nonferrous

20C-21. Flaring Tools, Tubing, Combine To Effect Large Saving. *Screw Machine Engineering*, v. 11, Nov. 1949, p. 46-48.

Unusual setup used to produce brass tubular part with flared end on the automatic screw machine.

20C-22. Watchmakers' Lathe Adapted for Repetition Work. P. Gates. *Machinery* (London), v. 75, Oct. 13, 1949, p. 534.

Setup for cutting short pieces of nickel tube 0.75 mm. in diam. and 5 mm. long from relatively long lengths in large quantities.

20C-23. Short-Stroke Broaching of Die Castings. H. K. Barton and L. C. Barton. *Machinery* (London), v. 75, Oct. 27, 1949, p. 615-620.

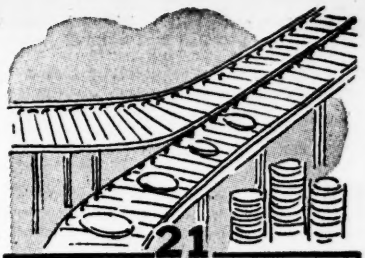
Clarified by schematic diagrams.

20D—Light Metals

20D-23. Centrifugally Actuated Fixture Eliminates Chatter. *Iron Age*, v. 164, Nov. 3, 1949, p. 99.

Fixture used in facing a "reaction flange" (die-cast Al) for Buick Dynaflow transmissions.

For additional annotations indexed in other sections, see:
3B-240; 13-70; 14B-130; 14C-92; 21A-58



21 MISCELLANEOUS FABRICATION

21A—General

21A-58. Production Engineering Research Association. D. F. Galloway. *Research*, v. 2, Oct. 1949, p. 471-477.

Work of British cooperative organization of engineering firms. Research on the drilling operation as applied to metals.

21A-59. Modern Equipment at Work. *Modern Machine Shop*, v. 22, Nov. 1949, p. 196, 198, 200, 202, 204.

Crush grinding 4,000 parts per hour; special machine for tapping cylinder blocks; new installation boosts brazing rate; and power brushing used for cleaning shovel blades.

21A-60. Engineered Expansion Pays Off in More Efficient Production. E. F. Ross. *Steel*, v. 125, Nov. 14, 1949, p. 80-82.

How manufacturer of electric and pneumatic portable tools has modified machining, heat treating, finishing, and assembly operations to keep pace with increased volume of business.

21B—Ferrous

21B-71. Production Problems of Turbojet Engines. T. S. McCrae. *SAE Quarterly Transactions*, v. 3, Oct. 1949, p. 582-591.

While these problems are no more complex than those encountered with reciprocating engines, they are of a different nature, since the major portion of the turbojet engine is welded sheet-metal structure. The so-called hot parts—combustion chamber, nozzle diaphragm, turbine, and tail cone—also present new problems. Problems associated with engine testing, fuel-control systems, etc.

21B-72. Steel and Electricity in Partnership. George L. Beaver. *Western Machinery and Steel World*, v. 40, Oct. 1949, p. 66-69, 96-97.

Steel-plate processing equipment, including electrical circuits, of Columbia Steel Co., Pittsburg, Calif. Includes pickling, cold rolling, shearing, annealing, tinning, galvanizing, etc.

21B-73. Seattle's Sawsmiths. Ralph G. Paul. *Western Machinery and Steel World*, v. 40, Oct. 1949, p. 70-73.

Production of circular and band saws.

21B-74. West Coast Firm Produces Complete Plants. Gilbert C. Close. *Modern Machine Shop*, v. 22, Nov. 1949, p. 100-106, 108, 110-111.

Miscellaneous fabrication equipment and procedures for construction of complete oil-refining and chemical-processing plants.

21B-75. Pop Corn Vendor Has a Variety of Exterior Finishes. Ezra A. Blount. *Products Finishing*, v. 14, Nov. 1949, p. 12-16, 18, 20, 22.

Manufacture of popcorn vendor bodies by forming and resistance

welding, and their finishing by spray painting and infrared baking. Stainless-steel reinforcing rings and coin-insert plates are electropolished to mirror brightness.

21B-76. Production of Stainless Steel. Parts I–III. B. H. DeLong. *Steel*, v. 125, Oct. 31, 1949, p. 64, 66, 69-70, 72-73; Nov. 7, 1949, p. 132, 134, 137-138, 140; Nov. 14, 1949, p. 102, 104, 106, 109-110, 112, 115.

Part I: history of development; manufacture of stainless-steel ingots; melting and refining practice; forging and rolling; pickling; electropolishing; and wire drawing. Part II: types and causes of corrosion encountered in service. Steels are divided into three groups and data are tabulated. Part III: the various types of stainless steel, their physical properties, fabrication considerations, and indicated uses.

21B-77. Large Production Equipment Required for Caterpillar Steering-Clutch Cases. Arthur W. Johnson. *Machinery* (American), v. 56, Nov. 1949, p. 186-193.

In producing these housings, weighing about 800 lb. each, steel plates as thick as ⅝ in. are blanked, formed, and welded together, and the welded assemblies are machined to precision tolerances. Equipment and procedures.

21B-78. The Production of Vauxhall Cars; Methods Employed at the Luton Works of Vauxhall Motors Ltd. *Machinery* (London), v. 75, Oct. 27, 1949, p. 583-607.

Numerous machine-shop, press-work, and miscellaneous procedures and equipment as applied to specific operations.

21C—Nonferrous

21C-8. Fabrication of Copper-Base Alloys. *Metal Industry*, v. 75, Oct. 14, 1949, p. 314-316.

Equipment and procedures of Dives Works of Compagnie Générale du Duralumin et du Cuivre in France.

21C-9. Gone Are the Days of the Old Wash Boiler. *Inco*, v. 23, Fall 1949, p. 16-19.

Materials, equipment, and procedures for production of hot-water heaters. Test procedures and Ni alloys used.

21D—Light Metals

21D-17. Short Runs and Specialized Production at Brown Trailers, Inc., Spokane, Wash. Howard E. Jackson. *Modern Industrial Press*, v. 11, Oct. 1949, p. 16, 18, 22.

Procedures and equipment in production of custom-built Al truck trailers. Press, machining, heat treating, foundry, and inspection procedures.

For additional annotations indexed in other sections, see: 3C-210; 7A-178; 18A-33; 19B-211; 22B-399; 22D-70

Abstracts of 3467 articles on

WELDING

Published during the past five years are available to you. *Complete your set of five volumes of A.S.M. Review of Metal Literature now.* Order from American Society for Metals, 7301 Euclid Ave., Cleveland 3, Ohio.

22 JOINING and FLAME CUTTING

22A—General

22A-240. Welding. Improved Techniques Multiply Uses. W. A. Saylor. *Western Metals*, v. 7, Oct. 1949, p. 35-38.

Welding in general. New process, introduced for welding heavy sections, which uses a consumable electrode of the same composition as the material being welded. Submerged-arc welding, weld cracking, and structure restraint.

22A-241. Needles and Pens. Lee H. Judge. *Welding Engineer*, v. 34, Nov. 1949, p. 23.

Use of resistance welding to join the precious-metal tip to the shank of a phonograph needle or the nib of a pen.

22A-242. Welded Steam Generator. William C. Henzlik. *Welding Engineer*, v. 34, Nov. 1949, p. 29-33.

Design and fabrication of generator used to provide steam heat and hot water on diesel-powered streamliners.

22A-243. Rectified D-C Welding. T. B. Jefferson. *Welding Engineer*, v. 34, Nov. 1949, p. 39.

New machine using a full-wave rectifier with a conventional three-phase transformer.

22A-244. Welding and Cutting Fumes. Clyde B. Clason. *Welding Engineer*, v. 34, Oct. 1949, p. 46-50; Nov. 1949, p. 34-38.

Surveys current literature on fume hazards for various metals and alloys. 26 ref.

22A-245. Modular Panels of Armorply. Light-Gage Metal Bonded to Plywood Prefabricated for Walk-In Coolers. *Sheet Metal Worker*, v. 41, Oct. 1949, p. 41-42.

The facing material is 28-gage stainless, electrolytic Zn-coated steel or 0.016-in. Al. The metal is bonded to the plywood with a special glue under high pressure.

22A-246. Glass-To-Metal Seals: The Applications of Iron-Nickel-Cobalt Alloys. *Metal Industry*, v. 75, Sept. 30, 1949, p. 263-266; Oct. 7, 1949, p. 292-293.

Problems involved, including types of seals, types of glasses, and types of metals and alloys.

22A-247. Zur Theorie des Brennschneidens. (The Theory of Flame Cutting.) Peter Grassmann. *Zeitschrift für angewandte Physik*, v. 1, Aug. 1949, p. 449-454.

Principle of flame cutting as applied to metals. Correlation of cutting rate with thickness of material and oxygen pressure. Further research required.

22A-248. Über die Gestaltung von Schweisskonstruktionen. (Weld Design.) K. Bobek. *Archiv für Metallkunde*, v. 3, Sept. 1949, p. 301-305.

Principles of design.

22A-249. Automatic Flash Butt Welding and Certain of Its Electrical Characteristics. (In Russian.) A. M. Lushnikov. *Avtogennoe Delo* (Welding), May 1949, p. 7-9.

Device to be attached to a regular butt-welding machine. Optimum conditions of operations.

22A-250. New Heavy-Duty Torch for Surface Cutting. (In Russian.) S. G. Guzov. *Avtogennoe Delo* (Welding), May 1949, p. 25-27.

Newly designed oxygen-cutting torch. Optimum conditions of operation.

22A-251. Submerged Arc Welding Coil Ends. *Iron Age*, v. 164, Nov. 10, 1949, p. 87.

Semi-automatic strip splicer, designed for welding together the sheared ends of strip coils to form a continuous strand through processing lines and for subsequent cold reduction.

22A-252. Inert-Gas Welding. H. A. Huff, Jr., and A. N. Kugler. *Canadian Metals and Metallurgical Industries*, v. 12, Sept. 1949, p. 16-19, 39; Oct. 1949, p. 16-19, 30-32, 36.

A descriptive review.

22A-253. Polyisocyanates in Bonding. T. J. Meyrick and J. T. Watts. *IRI Transactions*, v. 25, Oct. 1949, p. 150-166.

Experimental work on the technological applications of mixtures of rubbers and polyisocyanates in the bonding of natural and synthetic rubbers to textiles, to metals and to miscellaneous plastics, ceramics, and wood. No satisfactory method has been found for bonding rubber to copper, stainless steel, or phosphor bronze. 11 ref.

22A-254. Solid-Phase Bonding of Aluminum Alloys to Steel. V. W. Cooke and A. Levy. *Journal of Metals*, v. 1, sec. 1, Nov. 1949, p. 28-35.

Three procedures which are said to give very high bond strengths. These are the twisting, the hot-press, and the shear procedure. Variables investigated were bonding temperature, pressure, surface preparation, deformation, composition, and subsequent heat treatment. Application to other metal combinations is suggested.

22A-255. Welding Copper To Other Metals Speeded Up By New Process. Dan Reebel. *Steel*, v. 125, Nov. 14, 1949, p. 84-86.

Equipment and method for welding copper to copper or copper to steel in which no outside source of heat is required. Known as the Cadweld process, it is similar to Thermit welding except that iron oxide has been replaced by copper oxide. Applications have been worked out where connections can be made to flat and curved surfaces in both horizontal and vertical planes and in a range of wire sizes from No. 14 through 2000 MCM.

22A-256. Hard-To-Weld Ironbase Metals, As Well As Many Dissimilar Metals and Alloys May Be Economically Joined and Hardfaced With These Special Types of Bronze Electrodes. F. E. Garriott. *Industry and Welding*, v. 22, Nov. 1949, p. 40-42, 46-47.

Deals with Al bronze electrodes.

22A-257. The Argonarc Welding Process. R. R. Sillifant and W. A. Woollcott. *Welding*, v. 17, Oct. 1949, p. 430-441; Nov. 1949, p. 493-506.

Fundamentals; characteristics of d.c. and a.c. argon-shielded arcs; British equipment and methods of welding. Concluding installment: Manual and argon-arc welding of different materials.

22A-258. Gelötete Schienenverbinder. (Soldered Rail-Cable Connections.) R. Gunnert. *Zeitschrift für Schweisstechnik; Journal de la Soudure*, v. 3, Mar. 1949, p. 43-47.

The problem of soldering or weld-

ing copper cables to adjoining rail ends on electrified railways. A soldering device that prevents overheating of cable and cable shoe.

22A-259. Moisture Resistance of Electrode Coatings. (In Russian.) E. D. Lonskii. *Avtogennoe Delo* (Welding), June 1949, p. 17-20.

A series of coated electrodes used in the U.S.S.R. were investigated for moisture pick-up during storage. This amounted to 3-5%, but apparently did not affect weld qualities.

22B—Ferrous

22B-382. Ship Repairs by Thermit Welding. R. A. Forster. *Iron Age*, v. 164, Oct. 20, 1949, p. 71-73.

Defective stern frames of two Matson Line freighters were repaired by thermit welding, using about 3000 lb. of thermit. Preparation and welding techniques.

22B-383. Welding Stainless Steel. Lester F. Spencer. *Iron Age*, v. 164, Oct. 20, 1949, p. 57-62; Oct. 27, 1949, p. 69-75.

First installment: behavior in the various resistance, arc and gas welding techniques; practical recommendations. Concluding part: welding various types of stainless steels by spot, seam-roller, arc, submerged-melt, inert-gas shielded-arc, and gas methods. Economies of the various techniques.

22B-384. 865-Mile Pipe Line. T. B. Jefferson. *Welding Engineer*, v. 34, Nov. 1949, p. 20-22.

Welding equipment and procedures on new 26-in. line from Texas to Ohio.

22B-385. Hollywood's All-Welded Country Club Hotel. Mark Finley. *Welding Engineer*, v. 34, Nov. 1949, p. 24-25, 28.

New 224-room, three-story hotel has structural members of lightweight alloy steel.

22B-386. Pressure-Welded Rails in Cascade Tunnel. Ray Bloomberg. *Welding Engineer*, v. 34, Nov. 1949, p. 26-28.

Equipment and procedures for laying rails.

22B-387. Custom Tailored Steel. A. S. Blodget, Jr. *Welding Engineer*, v. 34, Nov. 1949, p. 40-41.

Welding procedures in manufacture of textile feeding machines.

22B-388. Das Schweissen korrosionsbeständiger Stähle; Le soudage des aciers anticorrosifs. (The Welding of Stainless Steels.) Rudolf Pospisil. *Zeitschrift für Schweisstechnik; Journal de la Soudure*, v. 39, Sept. 1949, p. 159-166.

Properties, structures, and methods of welding of 13 different stainless steel compositions.

22B-389. Characteristics of Oxy-Acetylene, Atomic Hydrogen, and Arc Welding of Stainless Steel Sheet, Type "Ya 1-T". (In Russian.) A. G. Mazel. *Avtogennoe Delo* (Welding), May 1949, p. 1-4.

Investigated for different thicknesses of sheet and different temperatures. Electric-arc welding is best for butt welding sheet thicker than 1.5 mm.; atomic-hydrogen welding for thinner sheet. Oxy-acetylene welding should be used only when arc or atomic-hydrogen welding is not feasible.

22B-390. Oxygen Cutting of Metal Without Continuous Heating. (In Russian.) I. S. Dmitriev and N. M. Madatov. *Avtogennoe Delo* (Welding), May 1949, p. 4-7.

Method of cutting steel with a stream of oxygen in which the necessity for continuous heating of the outer layer of steel by an auxiliary heat source is eliminated. The oxygen is heated before it strikes the surface of metal to be cut by passing it through a graphite tube heated initially by the electric arc.

22B-391. Technology of Automatic Welding of Thick Steel 15-M Under Flux As Applied to a High-Pressure Boiler. (In Russian.) B. I. Lazarev and I. D. Davidenko. *Avtogennoe Delo* (Welding), May 1949, p. 10-16.

Investigated for steel 70-90 mm. thick. Longitudinal and circumferential seams completely satisfying the requirements of high-pressure boilers are obtained on such steel using high-Mn fluxes and single-pass automatic welding with electrodes of the same steel of 10-mm. diameter.

22B-392. Flux Blocking During Automatic Welding of Storage Tanks. (In Russian.) I. N. Gerasimenko. *Avtogennoe Delo* (Welding), May 1949, p. 16-17.

Use of flux blocks. Automatic welding using flux blocks is limited in its extent; suitable conditions are indicated.

22B-393. Welding of Low-Alloy Steel With High Phosphorus Content. (In Russian.) D. M. Levykin. *Avtogennoe Delo* (Welding), May 1949, p. 18-19.

A welded assembly of low-carbon, low-alloy steel containing up to 0.15% P, using given electrodes, possesses the satisfactory mechanical properties of the base metal.

22B-394. Elimination of Weld-Seam Defects by Means of a Torch for Surface Oxygen Cutting. (In Russian.) V. A. Toropov. *Avtogennoe Delo* (Welding), May 1949, p. 23-25.

Use of a specific Soviet torch for removing flaws in welds and preparing joints for welding. This torch is of the injector type. Application to welded gas-storage tanks.

22B-395. Roller Machine for Welding Stainless and Heat Resistant Steels and Alloys. (In Russian.) J. I. Kislyuk and E. M. Eskin. *Avtogennoe Delo* (Welding), May 1949, p. 27-30.

Machine is capable of welding objects up to 1.5 mm. thick.

22B-396. Induction Brazing Cuts Cost of Motorcycle. *Product Engineering*, v. 20, Nov. 1949, p. 102-103.

Die castings and induction brazing were major features of design.

22B-397. Assembly-Welding and Finishing Protectobodies. Robert I. Shore. *Products Finishing*, v. 14, Nov. 1949, p. 32-35.

Production of Coca-Cola truck body of aluminum and steel. It is finished in high-gloss enamel and trimmed with stainless-clad steel.

22B-398. Submerged-Arc Welding Speeds Double-Jointing 30-Inch Pipe in the Field. J. E. Kastrop. *World Oil*, v. 129, Nov. 1949, p. 226-227, 230, 232.

22B-399. Guest Executive on Plant Tour. *Factory Management and Maintenance*, v. 107, Nov. 1949, p. 112-117.

Procedures and equipment of Standard Tube Co., manufacturers of resistance-welded tubing. (Question and answer dialogue.)

22B-400. Carbon-Arc Welding Seals Gear Case. Fred Gandert. *American Machinist*, v. 93, Nov. 17, 1949, p. 94.

22B-401. Today's Pipe Welding Practices. F. C. Fantz. *Heating, Piping & Air Conditioning*, v. 21, Nov. 1949, p. 81-86.

Use of welding for fabrication of special assemblies from formed and welded plate and their attachment in the line.

22B-402. Reinforced Concrete Is Replaced by Field-Welded Steel Dikes. Fred L. Plummer. *Industry and Welding* v. 22, Nov. 1949, p. 26-28, 76.

Dikes are used to encircle petroleum-product storage tanks in built-up areas in order to reduce hazards in case of tank failure. Welded steel dikes and their construction.

22B-403. High Production of Small Compressors. (Concluded.) Paul M. Giles. *Industry and Welding*, v. 22, Nov. 1949, p. 43, 61.

Automatic arc welding, handling, and soldering procedures.

22B-404. Über Eigenspannungen von Punktschweissverbindungen. (Internal Stresses in Spot Welds.) Viktor Hauk. *Zeitschrift für Metallkunde*, v. 39, Sept. 1948, p. 276-279.

Internal stresses to be expected from spot welding. Radial and tangential stresses in the vicinity of application of heat to a steel disk, in the vicinity of a single spot weld, and in the vicinity of a double row of spot welds were measured by X-ray diffraction. 24 ref.

22B-405. Construction en série de péniches soudées. (Assembly-Line Production of Welded Barges.) D. Réville. *Soudure et Techniques Connexes*, v. 3, July-Aug. 1949, p. 149-156.

Production from prefabricated structural elements. Cost savings.

22B-406. Automatic Flash Welding of Chromium-Molybdenum Steel Tubes. (In Russian.) A. S. Gel'man and N. S. Kabanov. *Avtogennoe Delo* (Welding), June 1949, p. 8-16.

Optimum conditions of operation, including post heat treatment.

22B-407. Two-Element Tool Joined by Hard Solder. (In Russian.) G. S. Belyaev. *Stanki i Instrument* (Machine Tools and Equipment), v. 20, May 1949, p. 15-17.

Method for joining, using a hard solder consisting of Cu, Fe, and Ni, with additions of Mn and Si. This solder possesses good fluidity and the soldered tool may be heat treated at 1210-1330° C. without reducing the strength of the joint.

22B-408. (Book) **Weld Design.** H. D. Churchill and J. B. Austin. 216 pages. Prentice-Hall, Inc., 70 Fifth Ave., New York 11, N. Y. $6.65.

Written primarily for the machine-base designer, this volume treats the subject of design from both the practical and theoretical standpoints. Principal emphasis is on the many methods of processing plates and structural shapes to produce economical welded machine-base construction.

22C—Nonferrous

22C-30. Die Schweissung von Fahrdrähten aus Kupfer. (The Welding of Copper Trolley Wires.) H. H. Grix and K. Boeckhaus. *Schweissen und Schneiden*, v. 1, July 1949, p. 109-114.

Principles of copper welding. Compares tensile strength of welded trolley wires with those secured by clamps. Electrical resistance measurements indicate no difference between welded and unwelded wires.

22D—Light Metals

22D-68. Stud Welding Speeds Aluminum Roofing Application. *Sheet Metal Worker*, v. 41, Oct. 1949, p. 30-31.

22D-69. Heliarc Welded Aluminum Spools. *Light Metal Age*, v. 7, Oct. 1949, p. 20.

Welding technique.

22D-70. Welded Aluminum Tank Cars. *Industry and Welding*, v. 22, Nov. 1949, p. 24-25.

Picture story shows production sequence from sheet rolling through welding to inspection.

22D-71. New Inert-Arc Process Increases Production. *Industry and Welding*, v. 22, Nov. 1949, p. 36, 38-39.

Case history on use of the new gas-shielded metal-arc process with continuously fed consumable wire for constructing special aluminum vessels (material over ¼ in. thick) on a production basis.

22D-72. Principe d'une méthode d'étude

Lehigh Cooperates With Bethlehem in New Course

Lehigh University, in cooperation with Bethlehem Steel Co., has announced a new program of practical study in metallurgical engineering, to begin in the fall semester of 1950. A graduate course, it will lead to the degree of Master of Science in Metallurgical Engineering Practice. It is patterned after the School of Chemical Engineering Practice at Massachusetts Institute of Technology.

As part of the curriculum a field station will be established at the Bethlehem plant. Robert D. Stout, associate professor of metallurgy, will be director of the field station, and Charles H. Herty (past president A.S.M.) will be the company's liaison man.

Students will spend 24 weeks at the field station carrying on original investigations of a development and plant test nature. After this practical work is completed, they will be required to carry a curriculum of 15 hr. at Lehigh during the spring semester.

Quarter-Century Club

The following A. S. M. members have been awarded honorary certificates commemorating 25 years' consecutive membership in the society:

Detroit Chapter—F. G. Davis; O. W. McMullan.

New Jersey Chapter—Tom G. Gilley; Keith R. Rodney.

Two Fellowships Offered

Two fellowships have been announced at Missouri School of Mines and Metallurgy, Rolla, Mo., and will be available for the semester beginning Jan. 30, 1950. A National Lead Fellowship in metallurgy is offered by the Titanium Alloy Mfg. Div. of National Lead Co., with a stipend of $1500 a year for a two-year period, while the Ludlow-Saylor Wire Co. of St. Louis will sponsor a fellowship to encourage the study of problems related to the manufacture of wire cloth. It also carries an annual stipend of $1500.

Further information may be obtained from A. W. Schlechten, chairman of the department of metallurgical engineering.

EMPLOYMENT SERVICE BUREAU

The Employment Service Bureau is operated as a service to members of the American Society for Metals and no charge is made for advertising insertions. The "Positions Wanted" column, however, is restricted to members in good standing of the A.S.M. Ads are limited to 50 words and only one insertion of any one ad. Address answers care of A.S.M., 7301 Euclid Ave., Cleveland 3, O., unless otherwise stated.

POSITIONS OPEN

East

MANUFACTURERS' REPRESENTATIVE: Covering metropolitan New York City and northern New Jersey for established midwestern manufacturer of high-strength corrosion resistant die castings. Graduate engineer with technical sales experience on production items desired. Send outline of education, experience and personal data. Box 12-5.

SALES ENGINEER: For heat treating products for entire Pennsylvania. Must have experience and close contacts with prospective customers. Willing to travel in own car Excellent earning opportunities Box 12-10

Midwest

METALLURGISTS: Senior men needed to conduct fundamental studies in various fields of metallurgy, including process, mechanical, high temperature, corrosion, fabrication, and welding. Must have five years of professional experience or an equivalent combination of training and experience. Please forward resume of education, experience, salary and pertinent personal data. Box 12-15.

RESEARCH ASSISTANT: With B.S. degree in metallurgy to work half-time on government-sponsored project and half-time taking course work leading to the M.S. degree. To start with the Spring term, Feb. 1, 1950. Box 12-20.

SALES ENGINEER: For reputable midwestern manufacturer of polishing and buffing compounds, solid and liquid. Excellent opportunity includes some existing accounts. Drawing account to start. Only men who are familiar with the field, or who are currently selling other products required by the same industries need apply. State age, experience, drawing account required, etc. Replies held in confidence. Box 12-90.

LABORATORY SUPERVISOR OR CHIEF METALLURGIST: For manufacturer of large diesel engines with gray iron foundry. Chemical background essential, with sufficient metallurgical experience for metal testing and analysis. Will have control of all raw materials, chemical and material processing such as heat treating, and services to engineering department. Also metallurgical and chemical inspection of field failures, and chemical and metallurgical trouble shooting on plant processes. Box 12-95.

Civil Service

INSPECTORS (STRATEGIC MATERIALS): For metals and ores (except iron and steel) as well as nonmetallic materials. Must have experience of a general nature in production, manufacturing, mining or milling of the materials. Some positions at higher level require supervisory experience. Salaries ranging from $3100 to $6400. For further information and application forms contact Civil Service regional offices or U.S. Civil Service Commission, Washington 25, D.C.

POSITIONS WANTED

METALLURGICAL ENGINEER: Graduating from Rensselaer Polytechnic Institute in January 1950. Age 26, married, veteran. Has summer experience with stainless steel company. Will consider any location. Interested in production or operations work or quality control. Box 12-25

POWDER METAL PRODUCTION OR SALES ENGINEER: Wide experience in development, production and sale of close tolerance parts—ferrous, nonferrous, magnetic, and electronic materials. Presently in charge of powder metal fabricating plant. Interested in sales connection backed by progressive manufacturer who desires to develop excellent contacts. Box 12-30.

MATERIALS AND METALLURGICAL ENGINEER: B.S. degree. 12 years' experience in steel, aircraft, teaching, and atomic energy. Diversified background in metallography, metallurgical laboratory techniques, literature research, coordination, liaison, trouble shooting, report writing, materials application, specification and standardization. Accomplished speaker and writer. Good appearance. Desires position combining administrative and technical duties. Will travel. Single. Location immaterial. Box 12-35.

LIGHT METALS ENGINEER: Graduate engineer with 16 years' experience. 13 years with aluminum producers as metallurgist, chemist and sales engineer. Three years as project engineer with transportation fabricator. Qualified in design, shop practices and trouble shooting. Age 40, family. Box 12-40.

METALLURGICAL ENGINEER: Ferrous and nonferrous experience. Has set up and supervised metallurgical and chemical laboratories, heat treating and plating departments. Nine years of basic steel experience. Age 37 married B.S. Box 12-45.

GRADUATE CHEMICAL ENGINEER: With training in electronics. Available as materials engineer or specification engineer. Box 12-50.

SMALL MANUFACTURING PLANTS—ATTENTION: Graduate metallurgical engineer desires responsible position with progressive company. Several years' experience with alloy steel producer. Age 33, married. Excellent references. Resume of experience and photograph sent promptly on request. Box 12-55.

MAINTENANCE ENGINEER: Age 36. Experienced plant maintenance, supervision, labor relations, cost, budgets, machine design, repairs, alterations and new installations. Production and cost minded. Excellent knowledge of chemical process, conveying, materials handling equipment, freight and passenger elevators, metal processing shops, electrical, mechanical and lubrication problems. Resume on request. Box 12-60

METALLURGICAL ENGINEER: B.S. in met. eng., 1940. Plant metallurgist and process engineer. Excellent experience in heat treatment, joining processes, tool materials, production processes and equipment, report and specification writing. Can tactfully handle investigation of plant troubles and field failures. Able to assume responsibility and supervise activities of others. Age 30, married. Box 12-65.

METALLURGICAL ENGINEER: B.S. from Case Institute of Technology. Two years' experience in production control and development work with nonferrous metals. Seeks position with midwestern firm (preferably near Chicago) in development or control work. Age 23 single. Excellent references. Box 12-70.

METALLURGICAL ENGINEER: B. Eng., M.S., registered professional engineer. Over 20 years' development, administrative experience in foundry, forge, heat treat, laboratory. Thoroughly familiar with all phases of automotive work, corrosion, powder metallurgy, special-service alloys, jet engine and gas turbine problems. Strong mechanical engineering influence. Customer contacts. Desires position as executive engineer, director of research or chief metallurgist. Box 12-75.

METALLURGICAL ENGINEER: Married, M.S. in metallurgy from Stevens Institute of Technology, 1948. Experience in laboratory and production. 12 years in ferrous and nonferrous metals industries. Seven years in research laboratory. Desires position in East. Complete resume of experience on request. Box 12-80.

METALLURGIST: B.S.Ch.E., Purdue University. Ten years' diversified experience in welding research, metallurgy, physical testing, heat treatment, and quality control. Some experience with high temperature alloys and aluminum. Steel mill experience. Desires position in development, industrial research or production. Prefers Northeast U.S. or Middle West. Married, age 32, three dependents, excellent health. Box 12-85

ENERGETIC YOUNG MAN: Excellent background and experience in metallurgy, chemistry, corrosion and ceramics. Desires sales development or sales service (trouble shooting). Several years of laboratory experience plus technical publications. Familiar with both ferrous and nonferrous metallurgy. Location immaterial; willing to travel; available immediately. Box 12-100

METALLURGICAL CHEMIST: Long experience in nonferrous smelting, scrap utilization. Has laboratory facilities for part-time work—analyses, consultation, research, etc Reasonable. Box 12-105.

METALLURGICAL ENGINEER: B. Met. E., recent graduate, age 31, married. Limited experience in powder metallurgy, chemical analysis of lead-base alloys and production problems (metal defects, lubricants, cleaning, pickling and welding). Desires position in production control or engineering sales with opportunity for advancement. Available immediately. Box 12-110

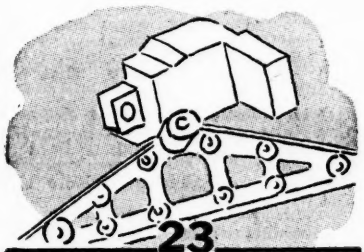
de soudabilité par points pour alliages légers. (Principles of a Method for Study of Spot Weldability of Light Alloys.) P. Borel. *Soudure et Techniques Connexes*, v. 3, July-Aug. 1949, p. 161-171.

Method consists in determination of the variables involved, such as degree of degreasing and pickling, optimum pressure, etc. Methods of determination of the variables and the apparatus used.

22D-73. Dauerhaltbarkeit von Leichtmetall-Nietverbindungen. (Strength of Light-Metal Rivet Joints.) H. Bürnheim. *Zeitschrift des vereines Deutscher Ingenieure*, v. 91, Oct. 1, 1949, p. 504-506.

Factors that help increase the strength of the joints. Test results.

For additional annotations indexed in other sections, see:
16A-101; 19B-215



23 APPLICATIONS

23A—General

23A-34. The Increasing Uses of Powdered Metal Parts. Joseph Geschelin. *Automotive Industries*, v. 101, Nov. 1, 1949, p. 27, 64, 67.

Use of "Oilite" bearings and finished parts.

23A-35. Strebausbau in Metall. (Metal Props.) O. Kuhn. *Zeitschrift des vereines Deutscher Ingenieure*, v. 91, Sept. 1, 1949, p. 425-430.

Use of adjustable steel and light-metal roof supports (props) in German anthracite mines. Need for further research.

23A-36. Orientamenti attuali circa la costruzione dei conduttori per le grandi linee di interconnessione internazionali e nazionali. (Present Trends in the Manufacture of Electrical Conductors for Long-Distance International and National Lines.) *Alluminio*, v. 18, June 1949, p. 241-253.

Present trend toward voltages above 220,000, and the construction and properties of conductors suitable for such voltages, especially those of aluminum-steel combinations. Advantages and disadvantages on the basis of a survey of Italy, France, Germany, Sweden, the U. S., and Canada.

23A-37. Kolloidchemisch interessante Metalle und anorganische Metallverbindungen. (Metals and Inorganic Metal Compounds of Interest From the Standpoint of Colloid Chemistry.) H. Bruno Waeser. *Kolloid Zeitschrift*, v. 113, June 1949, p. 180-192.

Patents on the chemical and metallurgical uses of the industrially more important metals and compounds.

23B—Ferrous

23B-59. The Story of Stainless Steel Strand. V. H. Godfrey. *Electric Light and Power*, v. 27, Oct. 1949, p. 82-84, 147.

Corrosion resistant and mechanical properties of stainless steel wire which have made its use for messenger, shield, and guy-wire applications economically justified through elimination of maintenance and replacement expense.

23B-60. How Stainless Steel Improves Screening Results. Charles G. Purnell. *Coal Age*, v. 54, Nov. 1949, p. 88-90.

Superiority of stainless steel for screens in refuse shakers, dewatering and desanding units, wet-sizing tables, air-cleaning tables, and chemical-treatment systems.

23B-61. Bergborrning med hardmetallskär. (Rock Drilling With Hard-Metal Tipped Steel Tools.) T. Ekstam, K. H. Fraenkel, and E. Ryd. *Jernkontorets Annaler*, v. 133, no. 8, 1949, p. 253-286; discussion, p. 286-298; English summary, p. 298-299.

Procedure for collection of data on length of life and failures of tools. Comparative figures have been established for drilling resistance of various types of rock. Effect of size of drill on durability.

23C—Nonferrous

23C-69. Metallic Polystyrene. *Modern Plastics*, v. 27, Nov. 1949, p. 76-78.

Plastic articles to which a metallic appearance is imparted by incorporation of metallic pigments, usually Al, Cu, or bronze alloys.

23C-70. Die Castings in the Household. Giftwares. Refrigerator Hardware. Washing Machines. Vacuum Cleaners. Power Lawn Mowers. *Die Castings*, v. 7, Nov. 1949, p. 19-26, 29-32, 36-39, 59-61, 68-71.

Varied applications of die castings.

23D—Light Metals

23D-114. New Machine Designed To Slash Printing Costs. *Modern Metals*, v. 5, Oct. 1949, p. 18-19.

Machine called "Printasign", made largely of aluminum, designed for printing signs and cards in six type sizes. Use of aluminum type box and carriage reduces weight, hence operator fatigue; and superior machinability reduces production costs.

23D-115. Aluminum Frame Development. *Modern Metals*, v. 5, Oct. 1949, p. 26-27.

Aluminum picture frames which can be taken apart and re-assembled. Extruded 63S-T5 is used for the frame proper and stamped 24S-T4 plate for the corner fasteners.

23D-116. Aluminum Box Car Carries Record Load. *Modern Metals*, v. 5, Oct. 1949, p. 28.

Weight savings and other advantages.

23D-117. Builders Concrete Forms Made of Magnesium. *Modern Metals*, v. 5, Oct. 1949, p. 31.

23D-118. How Permanente Finds New Uses for Aluminum. *Western Metals*, v. 7, Oct. 1949, p. 30-31.

Organization of the Permanente Metals Corp. research laboratory. Products and techniques introduced by the laboratory.

23D-119. Silo Roofs of Aluminum. *Sheet Metal Worker*, v. 41, Oct. 1949, p. 47-48.

23D-120. In the Nursery. *Light Metals*, v. 12, Oct. 1949, p. 543-547.

Various light-alloy applications.

23D-121. The Michelin Rubber-Tyred Train. *Light Metals*, v. 12, Oct. 1949, p. 551-559. Based on article in *Revue de l'Aluminium*, July-Aug. 1949, p. 239+.

Constructional details, showing extensive use of Al and its alloys.

23D-122. The Aluminium Roof in Tropical Service. *Light Metals*, v. 12, Oct. 1949, p. 583-585.

Results of the examination of Al-alloy roofing sheet in use under various unfavorable conditions in a tropical environment. Confirms suitability of the material for the purpose and its superiority over galvanized sheet and asbestos-cement board.

23D-123. Dachkonstruktionen für Industriehallen aus Leichtmetall. (Light-Metal Roof Construction for Industrial Buildings.) K. Renner. *Metall*, v. 3, Aug. 1949, p. 252-254.

Large-scale experiments have shown that light metals can be used for the construction of strong and corrosion resistant buildings. Methods of preventing corrosion (especially of contact corrosion). Details of design.

23D-124. Aluminum Crane Requires Less Hp. *Product Engineering*, v. 20, Nov. 1949, p. 105.

Overhead travelling crane of welded Al construction.

23D-125. Our Use of Magnesium Alloy Printing Plates. Paul E. Gallagher. *Photoengravers' Bulletin*, v. 39, Oct. 1949, p. 68-75.

Experiences and advantages.

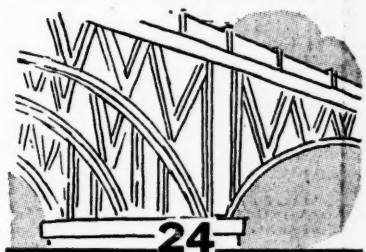
23D-126. Magnesium, Speed, and Progress. F. Richard Lilly. *Photoengravers' Bulletin*, v. 39, Oct. 1949, p. 76-79.

Experiences with use of magnesium printing plates. Recommended procedures.

23D-127. Magnesium and Its Commercial Aspects. Charles Wilhelm. *Photoengravers' Bulletin*, v. 39, Oct. 1949, p. 79, 82-85.

Use of Mg in printing plates from the standpoint of a commercial printer.

For additional annotations indexed in other sections, see:
1C-81; 2C-81; 3C-210-245; 6B-109; 6D-33; 14A-160; 18B-215; 22A-245; 22B-396



24 DESIGN

24A—General

24A-142. Stress-Strain Relations for Uniform Monotonic Deformation Under Triaxial Loading. J. H. Palm. *Applied Scientific Research*, v. A2, no. 1, 1949, p. 54-92.

A simple theory for the above. Suggests that a principal strain may be composed of two partial strains, each of which is exclusively a function of the corresponding principal shear stress. The theory yields results which agree on the whole as well or better with available experimental results than does the more complicated octahedral theory based on the Huber-von Mises-Hencky criterion. 22 ref.

24A-143. Stress-Strain Relations and Necking Criteria for Triaxial Loading, Two Principal Stresses Being Equal. J. H. Palm. *Applied Scientific Research*, v. A1, no. 5-6, 1949, p. 353-377.

A mathematical analysis of the problem. Continuation of work de-

scribed in a previous paper (see item 9-12, 1949).

24A-144. The Science of Valve Making. *Chemical and Engineering News*, v. 27, Oct. 24, 1949, p. 3132-3133.

Picture story shows equipment and procedures of laboratory devoted entirely to study of the design and building of steel valves. A prime objective is production of valves with a minimum of corrosion or erosion characteristics and with low pressure drop.

24A-145. Practical Design of Prestressed Pressure Vessel Shells. R. R. Maccary and R. F. Fey. *Chemical Engineering*, v. 50, Oct. 1949, p. 120-123.

Design criteria for various forms of construction which approach the ideal prestress pattern. Derives law to be followed in applying prestressed layers of any form, so that uniform tension will be achieved under pressure.

24A-146. Genaue Berechnung der Eigenspannungen in oberflächengedrückten Stäben von kreisförmigem Querschnitt. (Accurate Calculation of Internal Stresses in Surface-Stressed Round Bars.) O. Föppl. *Schweizer Archiv für angewandte Wissenschaft und Technik*, v. 15, Aug. 1949, p. 242-248.

Details of calculation, illustrated by graphs and diagrams.

24A-147. Form- und giessgerechte Konstruktion und deren Einfluss auf die Preisgestaltung der Gussstücke. (Proper Designs and Their Effect on the Cost of Castings.) J. H. Küster. *Die Neue Giesserei*, v. 36 (new ser., v. 2), Sept. 1949, p. 260-264.

Methods of simplifying the designs of castings in order to reduce costs.

24A-148. Retaining Bearings by Swaging. C. H. Avery and A. G. Brisack. *Iron Age*, v. 164, Nov. 3, 1949, p. 79-82.

Development of new bearing-retention techniques has resulted in weight reductions in aircraft bearing assemblies. Experiments on ferrous and nonferrous metals have resulted in a swaging technique that reduces the section thickness of bearing housings without affecting thrust load capacities, and yields cost savings in parts and assembly.

24B—Ferrous

24B-45. Analytical and Experimental Studies of Ladle Hooks. Carl W. Muhlenbruch. *Iron and Steel Engineer*, v. 26, Oct. 1949, p. 53-68, 70-71; discussion, p. 68-69.

Design and fastening method were studied by various test procedures, including strain-gage studies. Field tests were made on several types in order to determine effects of variations in design, method of fastening, and operating procedures. Types of riveted and welded joints. Resulting AISE design specifications.

24D—Light Metals

24D-17. Studio della forma più adatta per una struttura fusa in lega di magnesio in sostituzione di un' altra corrispondente in acciaio stampato e saldato. (Investigation of Optimum Design for Mg-Alloy Structures as Substitutes for Corresponding Ones of Formed and Welded Sheet Steel.) Roberto Guastalla. *La Metallurgia Italiana*, v. 41, May-June 1949, p. 135-143.

Details of work done in development of a satisfactory design of a cast Mg alloy wheel replacing a similar wheel formed from sheet steel.

24D-18. Superposition in Complex Straining. K. H. Swainger. *Proceedings of the Society for Experimental Stress Analysis*, v. 7, no. 1, 1949, p. 117-131.

The incremental theory applied to a duralumin plate round an expanded plug. 23 ref.

24D-19. Magnesium Alloys Simplify Jet Wing. *Product Engineering*, v. 20, Nov 1949, p. 101.

Redesign of F-80 jet-plane wing from Al to Mg alloys. Number of pieces was reduced from 1640 to 508 and fastenings from 42,700 to 16,000. The Mg wing requires less time and labor to produce. Additional economies are realized from reduced tooling, fewer drawings, and simplified inventories.

24D-20. Stresses in and General Instability of Monocoque Cylinders With Cutouts. VII. Experimental Investigation of Cylinders Having Either Long Bottom Cutouts or Series of Side Cutouts. N. J. Joff, Bruno A. Boley, and Joseph J. Mele. *National Advisory Committee for Aeronautics*, Technical Note 1962, Oct. 1949, 57 pages.

Eight 24S-T Alclad cylinders were tested in pure bending. Dimensions and cutouts are given. They were reinforced with stringers and rings of various cross-sectional areas and spacings. All but one cylinder failed in general instability. That one failed in tension.

24D-21. Plastic Buckling of Extruded Composite Sections in Compression. Elbridge Z. Stowell and Richard A. Pride. *National Advisory Committee for Aeronautics*, Technical Note 1971, Oct. 1949, 15 pages.

Theory originally developed for individual plates has been extended to apply to combinations of plates such as H and Z-sections, and was applied specifically to extruded H-sections of 75S-T6 Al alloy. Calculated buckling stresses agreed satisfactorily with experimental results.

24D-22. Data on the Compressive Strength of 75S-T6 Aluminum-Alloy

TECHNICAL BOOKS

Selected from the annotated listings in the A.S.M. Review of Current Metal Literature section of recent issues of *Metals Review*.

PRINCIPLES OF METALLOGRAPHIC LABORATORY PRACTICE, Third Edition. By George L. Kehl (McGraw-Hill)	$ 5.50
INDUCTION HEATING. By N. R. Stansel (McGraw-Hill)	3.50
STORY OF MAGNESIUM. By W. H. Gross (A.S.M.)	2.00
WELDING FUNDAMENTALS. By H. P. Rigsby (Pitman)	2.75
STRUCTURE AND PROPERTIES OF ALLOYS. Second Edition. By R. M. Brick and Arthur Phillips (McGraw-Hill)	6.00
ALLOY SYSTEMS. By James Osborn Lord (Pitman)	5.00
BASING POINT SYSTEM. By Fritz Machlup (Blakiston)	5.00
STRENGTH OF MATERIALS By C. O. Harris (American Technical Society)	4.90
MATHEMATICAL THEORY OF ELASTICITY. Fourth Edition. By A. E. H. Love (Dover)	5.95
MACHINING OF METAL. By Robert E. Smith (McKnight)	3.50
STEEL AND ITS HEAT TREATMENT: ENGINEERING AND SPECIAL-PURPOSE STEELS, Vol. III. Fifth Edition. By Bullens and Battelle (Wiley)	7.50
INDENTATION HARDNESS TESTING. By V. E. Lysaght (Reinhold)	5.50
METALLURGY AND MAGNETISM. By J. K. Stanley (A.S.M.)	4.00
MINERALS AND HOW TO STUDY THEM. Third Edition. By Edward Salisbury Dana. Rev. by C. S. Hurlbut (Wiley)	3.90
THEORY OF MODERN STEEL STRUCTURES: STATICALLY INDETERMINATE STRUCTURES AND SPACE FRAMES. Vol. II. By Linton E. Grinter (Macmillan)	5.25
POWDER METALLURGY. Vol. I. By Claus G. Goetzel (Interscience)	15.00
SOURCES OF ENGINEERING INFORMATION. By Blanche H. Dalton (Univ. of Calif.)	4.00
ENGINEERING METALS AND THEIR ALLOYS. By C. H. Samans (Macmillan)	7.50
MATHEMATICS AT WORK. By Holbrook L. Horton (Industrial)	6.00
EVALUATION OF RESIDUAL STRESS. By K. Heindlhofer (McGraw-Hill)	4.00

TERMS: All prices are net and subject to change without notice. We pay postage on orders accompanied by remittance. Books will be gladly sent for 10-day free examination, in U.S.A. only. Ohio residents add 3% state sales tax.

AUSTIN BOOK CO. 5409 St. Clair Avenue Cleveland 3 • Ohio

HERE'S HOW . . .

To get copies of articles annotated in the A.S.M. Review of Current Metal Literature

Two alternative methods are:

1. Write to the original source of the article asking for tear sheets, a reprint or a copy of the issue in which it appeared. A list of addresses of the periodicals annotated is available on request.

2. Order photostatic copies from the New York Public Library, New York City, or from the Engineering Societies Library, 29 West 39th St., New York 18, N. Y. A nominal charge is made, varying with the length of the article and page size of the periodical.

Write to Metals Review for free copy of the address list

METALS REVIEW

7301 Euclid Ave. Cleveland 3, Ohio

Flat Panels Having Small, Thin, Widely Spaced, Longitudinal Extruded Z-Section Stiffeners. William A. Hickman and Norris F. Dow. *National Advisory Committee for Aeronautics,* Technical Note 1978, Nov. 1949, 23 pages.

Test specimens and procedure. Concerned particularly with panels in which the ratio of thickness of stiffener material to skin material is small and the ratio of stiffener spacing to skin thickness is large. 14 ref.

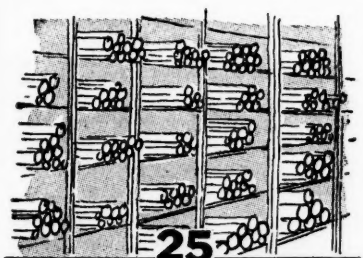
24D-23. Curved Plates in Compression. K. B. Jackson and A. H. Hall. *National Research Council of Canada,* Aeronautical Report No. 1, 1947, 98 pages.

Specimens and techniques used in two series of tests to determine load-deformation relations for curved Al-alloy plates with clamped edges under compression parallel to the axis of curvature. Results are analyzed and empirical equations derived for critical buckling stress, reduced buckling stress after loads exceeding the initial buckling stress, and post-buckling behavior or effective width. 10 ref.

24D-24. Aluminum Extrusions; Design Factors and Tolerances. H. V. Menking. *Machine Design,* v. 21, Nov. 1949, p. 127-132.

Cost savings made possible because of redesign from other forms to extruded sections.

For additional annotations indexed in other sections, see: 3A-238; 14C-96; 19A-256; 20A-475; 22A-248; 22B-408



25—MISCELLANEOUS

25A—General

25A-152. A Review of Current Alloy Casting Research. E. A. Schoefer. *Industrial Heating,* v. 16, Oct. 1949, p. 1771-1774, 1776, 1778.

Several research programs at Ohio State University, Battelle Memorial Institute, and elsewhere, for Alloy Casting Institute. Programs are on corrosion, on cast alloys for heat resistant service requiring development of a new thermal-fatigue test, and on welding characteristics of cast alloys and welding-rod compositions.

25A-153. Chemical Resources of the Western States. *Chemical and Engineering News,* v. 27, Oct. 17, 1949, p. 3000-3023.

Symposium summarizes the metallic and nonmetallic mineral positions of 11 states: "Arizona", Eldred D. Wilson and George H. Roseveare; "California", Olaf P. Jenkins and Charles V. Averill; "Colorado", Rolle Rand; "Idaho", Lewis S. Prater; "Montana", Perry F. Roys; "Nevada", Kenneth Frogley; "New Mexico", (anon.); "Oregon", F. W. Libbey; "Utah", Arthur L. Crawford; "Washington", J. V. Rogers, and "Wyoming", Jean L. Geyer.

25A-154. Some Aspects of Mineral Adequacy. Edward Sampson. *Canadian Mining and Metallurgical Bulletin,* v. 42 (*Transactions of the Canadian Institute of Mining and Metallurgy,* v. 52), p. 570-577.

Broad viewpoints on basis of national power, soils and fertilizers, energy resources, and mineral resources. Per capita production curves for the U. S. and for the world as a whole from about 1840 to date. Locations of major lead, copper, iron, phosphate, and potash resources.

25A-155. Die Anwendung kernphysikalischer Arbeitsverfahren im Eisenhüttenwesen. (The Application of the Nuclear-Physics Methods in Metallurgy.) Otto Rüdiger. *Stahl und Eisen,* v. 69, Sept. 15, 1949, p. 671-676.

Uses of radioactive elements, stable isotopes, and neutron radiation.

25A-156. American Machinist Mid-Century Inventory of Metalworking Equipment Shows Obsolescence Trend Sharply Up. *American Machinist,* v. 93, Nov. 3, 1949, p. 129-223.

Data obtained by a questionnaire survey of over 50,000 production plants, also college and maintenance shops. The data are broken down in various ways and supplemented by textual analyses.

25A-157. The Road Ahead in Engineering. J. R. Van Pelt. *Mechanical Engineering,* v. 71, Nov. 1949, p. 917-920.

Technologic advancements using the evolution of the reciprocating steam engine as an example. Further work lies ahead in improving the blast furnace, controlling the properties of metals, in ceramics, etc. Research as the key to progress.

25A-158. Ultrasonics Has Wide Industrial Applications. *Product Engineering,* v. 20, Nov. 1949, p. 153-154.

Various present and potential metallurgical and nonmetallurgical applications.

25B—Ferrous

25B-54. New Laboratory Concentrates on Steel Valve Research. *Steel,* v. 125, Nov. 7, 1949, p. 122, 124, 150.

Laboratory and equipment at Edward Valves, Inc., for testing all types of valves and valve materials.

25C—Nonferrous

25C-67. Our Next Major Metal—Titanium. *Product Engineering,* v. 20, Nov. 1949, p. 129-152.

What industry and researchers think of titanium; why use titanium; availability of the ore; production of the metal; mechanical properties of titanium; physical and chemical properties; fabrication techniques; and titanium alloys. 28 ref.

25C-68. The French Non-Ferrous Metal Industry. R. S. Lajeunesse. *Metal Industry,* v. 75, Oct. 14, 1949, p. 342-343.

Availability and production of various nonferrous metals.

25C-69. Unmanufactured Copper, Lead, and Zinc. *U. S. Tariff Commission,* July 1949, 58 pages.

Summarizes tariff information by type of material, country, and year. Annual and monthly consumption, production, imports, and exports in the U. S.

25C-70. Le Tungstène. (Tungsten.) Jean Challansonnet. *Métaux & Corrosion,* v. 24, July-Aug. 1949, p. 163-176.

Historical development, mineral sources, beneficiation, production, properties, metallurgy, fabrication, metallography and applications.

25C-71. (Book) **Titanium.** Jelks Barksdale. 590 pages. 1949. Ronald Press Co., 15 E. 26th St., New York 10, N. Y. $10.

Occurrence, chemistry, and technology; many commercial applications including those of the oxide. Reviews the literature and includes 78-page bibliography.

25D—Light Metals

25D-34. Aluminum and the Electrical Industry. Donald M. White. *Electrical Engineering,* v. 68, Nov. 1949, p. 928-933.

Economic and technological considerations, including parallel growth of aluminum and electrical industries, production of aluminum, electric equipment in aluminum-reduction plants, alloys useful in electrical industry, physical and mechanical properties of Al, and applications in electrical industry.

25D-35. Their Future. H. Sutton. *Light Metals,* v. 12, Oct. 1949, p. 564-572.

Present status of resources, production processes, and utilization of Al, Mg, and Be. 41 ref.

25D-36. Recent French Investigations in the Field of Light Alloys. Georges Chaudron. *Engineering,* v. 168, Oct. 14, 1949, p. 403-405. A condensation.

Effect of impurities on microstructure; electropolishing and other metallographic techniques; Al alloys prepared from high-purity materials.

25D-37. Recent French Investigations in the Field of Light Alloys. Georges Chaudron. *Journal of the Institute of Metals,* v. 76, Sept. 1949, p. 1-16.

See abstract of condensed version from *Engineering,* item 25D-36, 1949.

25D-38. La préparation du glucinium et de ses composés. (Production of Beryllium and Its Compounds.) J. Besson. *Bulletin de la Société Chimique de France,* Jan.-Feb. 1949, p. D15-D22.

Production, properties, and applications. 48 ref.

ADVERTISERS INDEX

Alox Corporation 41

Austin Book Co. 62

Burrell Co. 47

Electric Furnace Co. 53

Holden Co., A. F. .....
.....Front and Back Covers

Institute of Metals 54

Ryerson & Son, Inc., Jos. T. 23

Sentry Co. 54

— — —

A. P. Ford, Advertising Manager
7301 Euclid Ave., Cleveland 3, Ohio
Utah 1-0200

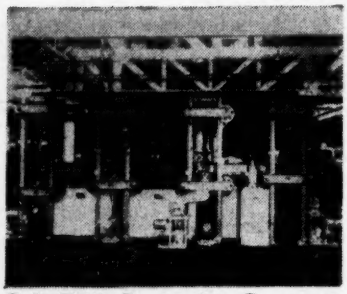
Robt. S. Muller, Eastern Manager
55 West 42nd St., New York 18
Chickering 4-2713

Don Harway, West Coast Rep.
1709 West 8th St., Los Angeles 14
DUnkirk 2-8576

57 Post St., San Francisco 4
Yukon 6-1069

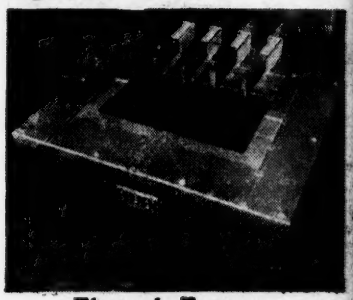
HOLDEN METALLURGICAL PRODUCTS

Salt Baths — Furnaces — Conveyors

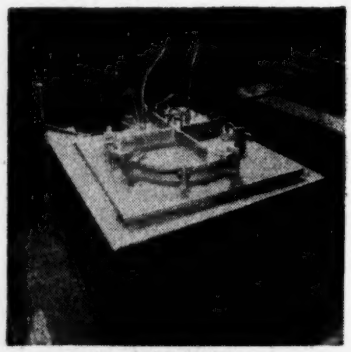


Salt Bath Processing Conveyor

Holden Liquid Electrode Furnace

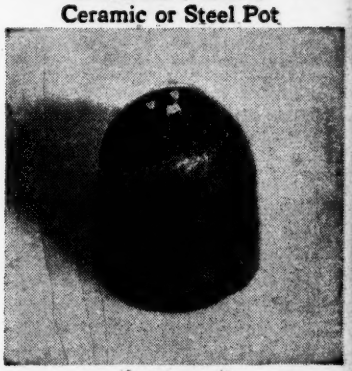


Electrode Furnace Ceramic or Steel Pot

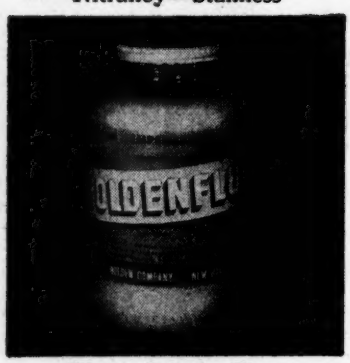


Liquid Nitriding Nitralloy—Stainless

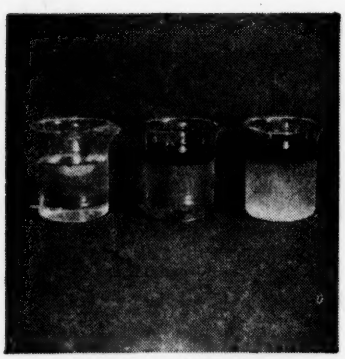
Prefabricated Ceramic Pot



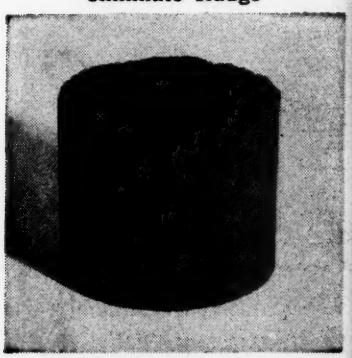
A new Holden alloy—to eliminate sludge



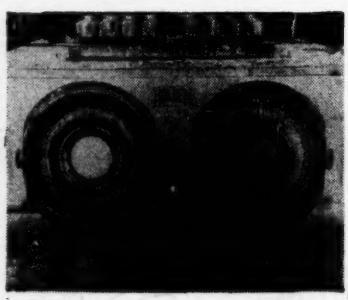
Water Soluble Flux



Soluble Oil can be reacted—waste used as a fuel

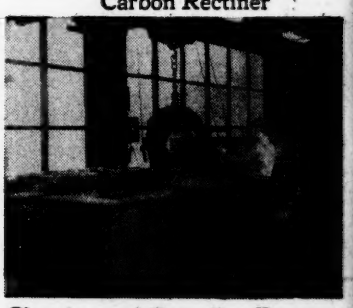


High Speed Salt Bath Carbon Rectifier



Before After

Marquenching Furnace



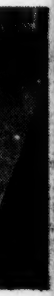
Cleaning and Descaling Furnace

Savings — There is more than one Holden Product that will reduce operating costs.

THE A. F. HOLDEN COMPANY • *Metallurgical Engineers*

MANUFACTURERS OF HEAT TREATING BATHS & FURNACES

NEW HAVEN 8, Conn. 1627 W. Fort Street, Detroit 16, Mich.

FOREIGN MANUFACTURERS Canada—Peacock Brothers, Ltd., Montreal France—Fours Electriques Ripoche, Paris
Belgium—Le Four Industriel Belge, Antwerp

REPRESENTATIVES IN TWENTY ONE FOREIGN COUNTRIES